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AUTHOR Noel, Jacques
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ABSTRACT

The first part of this dissertation is a metatheoretical discussion of the needs and means of semantic analysis. This discussion includes sections on metalanguage, deep and surface structure and structural semantics, and procedures for relating the English of abstracts to a classification concordance in the same language. The second part describes the experiment, in which a mechanized indexing system was developed and applied to 50 abstracts from a bibliography on documentation. In this system, each text word or symbol is replaced by a code, after which the machine performs step-by-step concatenations, rewriting two or more codes as a single code, until each abstract is rewritten as a single code. Part three is a discussion of problems of semantic representation in: (1) theoretical background--constituent-structure rules, lexical entries, and conjunction, discourse and relative clauses; (2) expressions such as "a discussion of..." and "this paper discusses..." (3) conjunction, relative changes and presupposition; (4) asymmetric conjunction--proposes an analysis in terms of case theory; and (5) examples drawn from the corpus that present difficulties for current case theory (for example, "as machines learn..."). The appendices contain descriptors, sample abstracts, and other material used in this study. A 14-page bibliography concludes the work. (KM)

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A SEMANTIC ANALYSIS OF ABSTRACTS

Around an experiment in mechanized indexing

Mémoire présenté pour l'obtention du grade
de docteur en Philosophie et Lettres, par

Jacques NOEL
Licencié en Philosophie et Lettres
(Université de Liège, 1957)
M.A. (University of Victoria, 1968)

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This thesis ends a fairly eventful career as a graduate student, a career during which I had to meet and study with several experts in linguistics and in automatic indexing in order to keep in touch with the two fast-moving fields which, as early as 1964, I set out to try to bring together in my work.

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PART I : METATHEORETICAL DISCUSSION

1.1. INTRODUCTION

> It may be that the next great advance in the study of language will require the forging of new intellectual tools that permit us to bring into consideration a variety of questions that have been cast into the waste-bin of 'pragmatics'.
> (Chomsky 1969a, 81).

1.1.1. Outline

The present metatheoretical discussion is concerned with the needs and means of semantic analysis : its purposes, including the requirements of form which it should meet; the role, nature, and interrelations of its components, including linguistic theory and its subdivisions; and the role of the linguist-observer. As I shall show in this introduction, such a discussion is necessary, for various reasons which have to do with the kind of topic I am dealing with : semantic analysis of English abstracts (summaries of scientific texts) in a particular field (scientific information, or documentation), and the mechanization of this analysis. The question raised in the second section of this introduction (1.1.2.) is why, according to some well-known standards and practices in 'pure' linguistics my topic is open to controversy in practically all respects, even though the same kind of topic is commonly dealt with in such areas of language studies as content analysis (Stone et al., 1966), and documentary analysis (in the field of documentation : e.g. Gardin and co-workers). This thesis as a whole may be regarded as an attempt to answer the above question by proposing an approach to semantic analysis in which some theoretical proposals made in linguistics and some metatheoretical positions underlying the documentalists' and content analysts' semantic investigations are regarded as complementary. As will be suggested, arguing for this mutual relevance is in itself doubly controversial in the present state of language studies; many linguists would deny the semantic study of texts a status in current linguistic science, while the content analysts in particular are doubtful about the relevance of linguistic theories to their semantic analyses of texts.

The third section of this introduction (1.1.3.) discusses the exclusive role commonly assigned to linguistic theory in linguistics and suggests that the arguments advanced for such a role, which are factual and not theoretical arguments, are fallacious as far as semantics is concerned in that they beg a crucial question to which the semanticist should address himself, and appeal to precisely the type of empirical facts which make up the semanticist's fundamental problems. One of these is the epistemological problem of how 'knowledge about language' is attained in the form of statements about language which owe their specific meaning and communicative function to their being part of a whole : a particular 'universe of discourse' - for instance, some linguistic literature - containing the particular knowledge shared by members of a community.

This problem, as I argue in section 1.1.4., has to do with the broad distinction made in logic and elsewhere between object-language and metalanguage (the language used to describe an object-language), and around various possible interpretations of this distinction. In fact, after Leech (1968, and 1969, 5), one can describe the semanticist's task as that of explaining what underlies such statements as x means y, and a particular semantic investigation can, at least in principle, be defined in terms of the selection which the investigator makes of the object-language (x) and metalanguage constituents (y), and of the various possible substitutes for means in such statements, among the many possibilities that are open to him; in addition, I would agree with Leech's suggestion (Leech 1968) that the relations between the linguist-observer's statements should be recognized as a fundamental problem in semantics. More generally, I shall argue that linguistic theories can be regarded as only one among various possible types of metalanguages, and that the relations establishable between these and the corresponding object-languages constitute the central empirical facts and epistemological problem with which a semanticist should be concerned. Classification systems and the various other kinds of 'documentary languages' set up and used by documentalists for purposes of scientific communication constitute the other type of metalanguage which is given a central role in this thesis. The proposed function of such a metalanguage in this thesis is intended to remedy another shortcoming (closely related to the first) of the conception assigning linguistic theory an exclusive role in semantic analysis. In this connection, I shall argue that a semantic metatheory needs to give recognition to limitations that are inherent to linguistic theory, namely that it is unable to specify the field-specific 'concepts' or "systems of knowledge and belief" (Chomsky) with which semanticists operate. Linguistic theory, for instance, is unable to specify the 'meanings' which documentalists will look for in the documentation abstracts under investigation in this thesis.

A further section of this introduction (1.1.5.) serves to argue, after Lyons, that the linguist can and should remain neutral towards a number of philosophical and psychological controversies about the nature of meaning and about the goals of semantic investigations of natural languages.

The last section of this introduction (1.1.6.) outlines the metatheoretical conception put forward in the rest of the first part of this thesis, chiefly after Gardin 1969, and on the basis of fairly recent theoretical developments within and around the trends of linguistics broadly referred to as transformational-generative (TG)theory : in particular, work by Harris, Lyons, Leech, Fillmore, and some of their co-workers. In brief, I shall follow Gardin 1969 in considering that semantic analysis needs to be based on three main components and that the purpose of a particular semantic investigation is to clarify their nature, structure, and interrelations : a metalanguage, such as a classification system or similar conceptual organizations used by content analysts; a theory; and a procedure, serving ideally to make the relations between metalanguage and object-language explicit by means of a system of rules. Metalanguage, theory, and procedure are further discussed in the last three chapters of the present metatheoretical discussion : 1.2., 1.3., and 1.4., respectively. The ideal underlying this three-component semantic analysis is, briefly, a reconciliation of 'conceptual' communication requirements put forward outside linguistics with the 'formal' requirements of TG linguistics.

The selection of my theoretical sources requires a word of explanation at this stage. First of all, it may seem that such authors as Harris and Fillmore have little in common. This may be the case as far as their theoretical proposals are concerned : in fact, they do not quote each other. From a metatheoretical point of view, however, I shall attempt to show in this thesis and in section 1.1.6. in particular, that they are relatable in terms of a basic dichotomy which needs to be made in linguistics between authors concerned with the communicative function of language and those who claim not to be, and a parallel distinction between preoccupations with distinctive statements versus a concern with 'general' statements, where the requirements of distinctiveness are left (at best) for a later stage of research. In this respect, I feel that some recent work by Harris and Fillmore, (in particular Fillmore's recent study of 'verbs of judging' and his explicit concern with semantic fields : Fillmore 1969b) display similar preoccupations with distinctive statements and with the communicative function of language. In addition, I must stress that the selection of my theoretical sources results from my experience of the field of linguistics during the preparation of this study and is governed by my judgments about the compatibility of the theoretical proposals in question with the topic of this study and with the metatheoretical conceptions I propose, My position .. . in this respect is in no direct way determined by such chance factors as influences undergone during my training in linguistics, still less by a priori decisions of the kind exemplified below by Botha's decision (Botha 1968) to work within the "single" framework of TG theory. Besides, irrespective of the research with which I may not be familiar, many studies not mentioned in this dissertation have been omitted either because I have found them irrelevant, or because I believe them to be reducible to, or superseded by, the studies which I refer to - at least as far as their applicability to my topic is concerned. This is especially the case of works belonging to various traditions of language studies which are mentioned or discussed in my M.A. thesis (Noël 1968), or by the linguists I refer to. In particular, I shall not attempt to bring in several studies in the field of logic as well as many European contributions to linguistics which are referred to in the publications of Lyons, Leech, and Fillmore. Similarly, I shall not refer to several works in various fields of language studies outside linguistics proper, because I am not acquainted with them and because a thorough discussion of these studies (supposing it is feasible) would have required a world-wide survey of semantic analysis methods which is beyond the scope of the present doctoral thesis. In particular, I shall not attempt to discuss several studies in the fields of literary analysis, documentary analysis and classification research, which are referred to in books and papers such as Coyaud 1966, Coyaud and Siot-Decauville 1967 and Gardin 1969, and in the bibliography of abstracts under investigation in this thesis (Janaske 1962).

1.1.2. A controversial topic.

In order to discuss the various controversial aspects of my thesis topic, it is useful to mention a few diverging attitudes among linguists on several important matters. These disagreements are well-known, but they need to be mentioned here as they have direct bearing on all the main features of my topic, and therefore on this topic as a whole.

First, there is disagreement as to the place of computers in linguistics. While quite a number of researchers, including 'pure' linguists, are engaged in computational linguistics, many linguists would refuse computers a place in their science, or do not feel the need to use them in their work. A striking example is the difference in this respect between Harris and his co-workers, who have been actively concerned with computer analyses (including the implications of "transformations" for the problems of documentary analysis discussed in this thesis : Harris 1970), and Harris's pupil, Chomsky. The mechanization experiment presented in Part II of this dissertation is intended to clarify a possible role of the computer in linguistics on the basis of proposals made by Harris and co-workers (after Harris's "string analysis": Harris 1965), *and* of Gardin's metatheoretical proposals as experimented by his co-workers, from Coyaud to Bély *et al.* 1970. In the experiment which I present, a small number of the documentation abstracts under investigation in this thesis are represented by string formulas stored beforehand in the computer. The machine operates with this grammatically organized material and gradually reduces the formulas recognized in each text to a single notation which stands for one or more entries of a classification system for documentation serving as a metalanguage for this field. This, then, is broadly the basis on which Part II of this thesis relates linguistic theory with the documentalists' (and the content analysts') conception of semantic analysis.

I also suggest that the mutual relevance of the two areas of language studies beyond this point may also be established when enough knowledge is gained on certain problems of semantic theory for semantic representation to be amenable to mechanization. These problems are discussed in Part III of the present dissertation. In principle, they concern equally the object-language under investigation (the English of abstracts on documentation), the various possible meta-languages (such as classification systems) relatable to this object-language, and the relations between the semantic representations establishable for both.

Another point of disagreement among linguists appears in their attitudes to various methodological distinctions (between syntax and semantics, grammar and lexicon, grammar and discourse) and in the frequent treatment of one of the problem areas thus labelled in methodological isolation. Prominent syntacticians, for instance, have generally left the semantic extension of their theories for later, or to other investigators, and, except in the last two decades or so, linguistic semanticists have shown little interest in syntax and have contributed little to the semantics of grammatical units larger than those dealt with by lexicographers. One of the main objectives of this thesis is to find a basis for going beyond such methodological distinctions, since my first concern is with people's ability to relate abstracts (i.e. texts usually consisting of a title and of one or more sentences) to one or more classification entries having the form of a lexical unit and a definition consisting of one or more sentences.

With respect to the linguistic study of units larger than the 'sentence' - another controversial aspect of my thesis - Zellig Harris occupies a unique place in linguistics.

Harris is one of the few prominent linguists to have been consistently interested in analyzing texts and discourses, and the only prominent 'pure' linguist to have dealt with scientific discourse. For this reason, one might think that the present study must draw heavily on Harris, or even be centred on an exploration of his proposals, particularly those on discourse analysis. This is not the case, however. As far as I can judge from the literature I know, the currently available illustrations and programmatic applications of discourse analysis and of related methods such as the transformational approach (in particular those presented in Harris 1968 and 1970) do not substantiate Harris's well-known claim that a linguist can deal with everything 'linguistically' and need not be explicit about the semantic criteria he uses, or at least need not wonder whether some of the components of his analyses can be rightly regarded as linguistic, or "grammatical". I feel that the problem, to which much of the metatheoretical discussion of this thesis is devoted (particularly around the notion of meta-language), concerns all varieties of the language, though it arises most dramatically with scientific varieties. Even if on-going research by Harris and his pupils should present extensive (instead of programmatic) analyses demonstrating the feasibility of reducing facts of discourse (such as equivalence classes in texts) to linguistic rules (such as transformations), one may still wonder how the facts and the corresponding rules can be established without appealing to some kind of culture or expertise which can neither be 'given' nor 'organized' by a linguistic theory. Even if Harris can set up 'grammatical' rules accounting for the similarity between members of an equivalence class in a particular text (between, say, "the study of denaturation" and "strong solution of urea"), one cannot help feeling that in order to be able to establish such facts he has had to consult a biochemist, or has himself received an extensive training in biochemistry, since this field has not been reduced to a linguistic theory, and probably never will be (Harris 1968, 148-153). My point here, which is a central one in the present thesis, is basically similar to that made most explicitly by Mounin (1965) about Dubois's attempt to set up semantic fields in French political and social vocabulary on the sole basis of substitutional and distributional techniques (Dubois 1963), and about his "implicit" use of "conceptual" criteria in applying such techniques :

> En fait, on décide, entre toutes les unités qui peuvent "former système" avec une autre à partir d'un ou plusieurs énoncés donnés, de ne retenir que celles qui sont sémantiquement apparentées (*la bourgeoisie, le prolétariat l'aristocratie, le capitalisme..., voilà l'ennemi*; mais non *l'alcool, le phylloxéra*, etc.). La présentation a l'air déterminée par des critères formels; en réalité, on a réintroduit une décision d'ordre conceptuel, implicite, dans le circuit opératoire. Ceci n'invalide pas la construction de tels champs sémantiques, mais attire l'attention sur le fait que, malgré les apparences, on n'a pas réussi à délimiter le champ sur des marques formelles, et d'après des procédures exclusivement et proprement linguistiques .(Mounin 1965, 135)

My concern with documentation English runs counter to another recognizable tendency in several contemporary linguistic studies, including some on which this thesis relies heavily (e.g. Fillmore). Many contemporary linguists have an obvious preference for drawing their examples from everyday language and seem reluctant to study other language varieties, such as the sublanguages dealt with by Harris and Dubois, or the language varieties examined in the tradition of semantic fields from Trier to Lyons's study of the role of epistemological vocabulary in the semantics of sentences from Plato (Lyons 1963). One of the consequences of this situation is that the present study deals with object-language terms which are often regarded or used as primitives in the linguistic literature : for instance, the words *information* or *communication*. More importantly - and the point is particularly relevant to the study of discourse - a scientific sublanguage must be taken as it is, in its attested manifestations, and the examples cannot be invented by the linguist-observer, in the same way as everyday sentences presumably can be. At least initially, the descriptions presented in this thesis cannot be neutral with respect to analysis and synthesis, as Chomsky and others have claimed a linguistic theory or description should be. This study cannot without oddity be concerned (at least directly) with language production or synthesis, and must give primacy to analysis : the definition of a metalanguage (given below in Cherry's formulation : Cherry 1957, 305) as "observer's language" reflects this primacy.

While the various forms of disagreement mentioned so far can perhaps be treated as a fact inherent to scientific research as a whole, one may still feel that the topic of this thesis is difficult to reconcile with the present state of linguistics. The abstracts under investigation may be expected to present almost all the main difficulties faced by past and present linguists (from most specific lexicological problems to the use of the article in English), with no obvious possibility of resorting to the kind of methodological simplifications that are possible when linguists invent their examples, or collect them after some finite inventory of theoretical criteria. This, one may argue, makes the topic of this thesis hopelessly complex considering "the state of our ignorance" (Leech 1969, 3, quoting Weinreich): for Fillmore, for instance, bachelor is "the only English noun that has so far been given a semantic analysis", and this linguist feels that "the world must wait another two or three decades before it will see anything resembling a respectable grammar of English" (Fillmore 1968b, 28-29). Indeed, considering the state of linguistics, various authors suggest that progress can only be achieved by the very preliminary simplifications of the field of inquiry that appear to be impracticable in this study : for example, the present investigation is apparently difficult to reconcile with Fillmore's recent suggestion (ibid.) that progress in linguistics is best served by trying to understand "the elementary structure of the propositional" core of simple sentences". To justify such simplifications, mention is occasionally made of other sciences which are said to owe their present degree of advancement and diversification to their pioneers' selection of relatively simple problems such as, say, perfect gases in chemistry. For some linguists, it appears that such an attitude has a direct bearing on the semantic study of texts as a field of inquiry in linguistics. As the following passage from Langendoen suggests, the argument is roughly that a semantic study of texts can only be misguided since it forces one to deal with just the two areas in which linguistic theories are assumed to be most inadequate. Thus, while he admits that some sentences and presumably some texts clearly belong to langue, as when a linguistic community decides that "a section of a legal document" is applicable to "a particular situation" Langendoen proposes to

> return to the Saussurean conception of words as belonging to langue, but sentences and discourses as belonging to parole-- not because we lack the theoretical apparatus to deal with sentences and discourses syntactically, but because we lack the necessary apparatus for dealing with them semantically in any systematic fashion (Langendoen 1967 , 107 and 101).

It should be noted, however, that an argumentation similar to Langendoen's can also be used to decide what a semantic analysis should be at the word level. This appears most typically in Leech's recent proposal to characterize names of animal species by means of "a single contrastive component" ("e.g. 1 SPE for 'dog', 2 SPE for 'cat', 3 SPE for 'elephant', etc.") and to exclude various other possible semantic features, such as 'having a trunk', 'ivory-producing', etc., for 'elephant'. As he neatly notes, the effect of this decision is that the theory will class, 'This elephant is a tiger' "as a logical contradiction" while it will treat 'This elephant has eighty legs' as "well-formed".

Leech bases his decision on the principle that

> "an investigator has reached the limits of semantics whenever he is faced with an indefinite number of criteria or partial criteria for distinguishing the meanings of a set of terms within the same semantic field", and any choice between those criteria can only appear to be "arbitrary"; "to have an infinitely or indefinitely long semantic specification would run counter to the whole notion of an explicitly formulated semantic description we have been considering". (Leech 1969, 87-88).

At this point, the reasons why the topic of this thesis appears to be controversial by several standards and practices of current linguistic research can be clarified by referring to a principle which Leech presents as underlying his semantic investigation, and which is most obviously relevant to Langendoen's point about the semantic study of discourses. It is the position which consists of *letting "the theory of semantics determine the extent of its subject-matter, rather than the other way round"*, where "theory" refers to "*standards internal to a semantic theory*" (Leech 1969, 80 and 85; my italics). I do not mean to say that all is clear about the relations between Leech's principle and the various standards and attitudes of current linguists which make my thesis topic appear as a controversial one. What I wish to suggest, however, is that the kind of principle which Leech formulates is the *clearest* thinkable way of pinning down the reasons why my topic can be judged in this fashion. Besides, this interpretation finds support in a recent appraisal of the situation of current linguistics by Botha, to be fully discussed in the next section (1.1.3.). Finally - and most importantly, as far as the argumentation of this thesis is concerned - the principles which Leech and Botha formulate hinge on an epistemological conception of the role of "theories" in language studies, which I wish to clarify in this thesis and which happens to be similar to the conception of semantic analysis of texts adopted by content analysts, as I wish to show in the rest of this section. The crucial difference, however, between the two attitudes is that Langendoen and others would object to the semantic study of texts because of the deficiencies of linguistic theory while the content analysts base their semantic analyses of texts on non-linguistic theories.

Semantic analysis of texts can be regarded as the central pursuit of natural language investigations in the fields of documentation and content analysis. The sociologists and psychologists involved in content analysis and the documentalists, whose responsibility is to serve as a link between writers and readers of scientific texts, are both concerned with how to characterize the meanings of texts. In both fields, essentially two approaches to this problem have been explored. One is the statistical approach, which is associated with such classical studies as Berelson (1952) in the field of content analysis, and with the works of such authors as Baxendale, Luhn, and others in the field of documentation. I shall not be concerned with the statistical approach in this thesis. A comparison between this approach and the other is beyond the scope of this study, as several publications by Gardin, Salton, and many others suggest, together with the many arguments advanced for and against the use of statistical methods in linguistics. Here, I shall be concerned only with the other approach. However one may wish to call it, whether it is practised by the content analysts working around Stone or by documentalists such as those of the Gardin team, it can be regarded as fundamentally the same approach; the similarity, which has been shown in Gardin 1969, will become obvious in the course of the present metatheoretical discussion. For the sake of presentation, I shall devote the rest of this section to the main features of Stone and his co-workers' approach to semantic analysis (as discussed in Stone et al., 1966). Afterwards, I shall concentrate on the documentalists' point of view.

The content analysts' preoccupations with recorded speech and writing that is relevant to their psychological and social sciences can be described as follows: "Much as the archaeologist infers the life of a culture from the pattern of remnants, so the content analyst infers the orientation and concerns of a speaker, subculture, or culture from the record of what is said" (ibid., 19). Thus, inference-making, or drawing conclusions from texts is the ultimate objective of content analysis. The texts which they analyze cover a considerable variety of subjects : political (e.g. presidential speeches), psychological (e.g. suicide notes), literary (e.g. Mark Twain's Huckleberry Finn), etc. The conclusions or inferences are made on the basis of what is called "content characteristics" or "categories". For instance, the content analyst will "rate a series of editorials on whether they are for, against, or neutral toward a particular policy". Or, they may want to identify the extent to which "conservatism", and various "characteristics" considered to be "signs of conservatism", are expressed in texts (ibid., 4 and 7).

As in documentary analysis, the emphasis is on the need for semantic analysis to meet certain requirements of form. These are met by aiming at "procedures for transforming intuitive judgments into explicit rules" (ibid., 5), that is, rules and procedures "that can be replicated exactly by other analysts" (ibid., 11). Computerization is regarded as essential to achieve this aim, next to other, practical, objectives such as "to ensure reliability and speed of coding while reducing its tedium" (ibid., 5); in fact, Stone et al. 1966 is essentially concerned with presenting a computer approach to content analysis called "The General Inquirer":

> The nature of a computer program requires that both the categories and the rules for identifying and recording characteristics occurring in the data be explicitly stated. The computer then systematically applies the categories and rules to the data in a completely objective manner. Whether the (...) procedure was reasonable or best suited to the inferences being made may be debated, but the procedures themselves are explicit and clear. (ibid., 12)

To help them make their procedures explicit, the content analysts obviously need "an adequate theory of the relationship between social scientific variables" (such as "conservatism" and its constituent characteristics) "and how they are expressed in language". From the outset, however, Stone et al. echo the linguists' pronouncements on the state of our ignorance; they point out that no such theory is currently available and stress the need for the investigator to "fall back on" his "intuitive" ability as a speaker of the language to specify as best he can "the alternative ways in which a characteristic can be expressed" (ibid., 11 and 8) :

> we lack an adequate theory of language to direct us in finding the alternative signs that express a particular concept. In a situation where something is to be said, there is no theory to tell us what words will be used to say it. (...) There is as yet no good theory of symbolic communication by which to predict how given values, attitudes or ideologies will be expressed in manifest symbols (...) "There is almost no theory of language which predicts the specific words one will emit in the course of expressing the contents of his thoughts" (quoted from Lasswell et al. 1952, 49). To be useful, such a theory will have to combine specific knowledge of the individual speaker and the perceived social situation, together with a general knowledge of language. (ibid., 9-10)

Moreover, when Stone and his colleagues refer specifically to linguistics as a possible foundation for their analyses, they repeatedly emphasize the differences between the linguists' objectives and their own. They do make use, it is true, of syntactic codes and ruled and contemplate a mechanization of the "hand syntax coding" they report (ibid., 161). But, giving the relatedness of "sit" and "chair" as an example of the difference between "distributional structure" and "the groupings of words used in content analysis", they stress that the similarities between their work and that of distributional linguists such as Harris "may be more apparent than real" (ibid., 60). With reference to linguistic semantics, they arrive at a similar conclusion. While they note "a remarkable operational parallel" with Katz and Fodor's (1963) proposals, they insist that their goals differ from that of these authors in that the purpose of content analysis is to infer the "origin, uses, and effects of signs within the behavior in which they occur" (ibid., 18).

Stone et al.'s attitude to linguistic theories is obviously negative. But the content analysts' research has, next to the requirements of form mentioned above, a positive aspect to which I now wish to turn, and which is central to my discussion. It is the consideration that, despite the handicap of having no adequate linguistic theory of "symbolic communication", semantic analysis can proceed perfectly well, on the basis of the central role which the content analyst gives to his social and psychological theories : "the theory being investigated (...) determines the texts to be compared (that is, the research design), the categories and rules for application that must be constructed, and the kinds of inferences that might be drawn" from the relations established between the texts and the categories (ibid., 14-16). To return to the example of "conservative" texts, the social scientists' theories will serve to determine all the essential components of their semantic analyses and their extensions except the specification of "the alternative ways in which a characteristic can be expressed" in language : the various constituent concepts of "conservatism", the selection of texts that will throw light on these concepts, the relations to be established between the texts and the concepts, and the ultimate exploitation of the analysis. Moreover, the first two steps of the analysis - the selection of texts and the definition of the "characteristics" - are taken on the basis of the theory, prior to the analysis itself.

Let us note, first of all, that this is not a claim which Stone et al. make about the nature of semantic analysis : it is a description of how their analyses are actually set up. Besides, the facts revealed by Stone and his colleagues are in contradiction with the claim made by some linguists and mentioned above in connection with Harris that linguistic data, and in particular texts, can be analyzed on the sole basis of a linguistic theory. Lastly, and most importantly as far as my argument is concerned, the linguists and the content analysts concur in assigning theoretical considerations a central epistemological role in semantic analysis. On the other hand, there are obvious differences between the two kinds of conceptions. Leech, say, does not insist as do the content analysts on the need for the relations between his 'categories' and the data to be amenable to testing with a computer. Moreover, the content analysts feel that they can carry out their semantic analyses on the basis of their non-linguistic theories, and do not regard the absence of an adequate linguistic theory as a fundamental obstacle, but merely as a handicap, while Leech assigns linguistic theory an exclusive place, even at the cost of excluding some facts from the scope of his investigation (as when 'This elephant has eighty legs' is treated as well-formed by the theory). In the following section, I shall attempt to clarify and discuss the kind of position advocated by Leech, after a recent study by Botha (1968).

1.1.3. Linguistic theory in linguistics.

In the opening section of his recently published dissertation, Botha 1968 presents an analysis of the current scene in linguistics which, judging from my experience of the field, I believe to be fundamentally correct. Moreover, I do not know of any other author who has made the same points so explicitly, and I suggest that they clarify Leech's proposal to "let the theory of semantics" (and "standards internal" to it) "determine the extent of its subject-matter, rather than the other way round" (Leech 1969, 80). Botha, then, points out that

> the linguistic research of an increasing number of present-day linguists is governed by (...) the general methodological or espistemological principle that extensive knowledge about "language" or "linguistic structure" can only be sought in the framework of a particular well-defined linguistic theory or model. I am not familiar with recent attempts that successfully prove the untenability of this principle. The case is rather that the linguistic argumentation of the scholars who do not hold this view is characterized by obvious methodological flaws...
> (ibid., 13; in a passage to which I shall return, Botha criticizes the use made by some linguists of terms such as 'the sentence', or 'the word' outside a particular theoretical framework : ibid., 81-83).

Botha immediately accepts this principle as a basis for his own investigation, together with another principle, "most convincingly formulated by Popper 1963", "that empirical science can only advance when scientists attempt constantly to refute their theories by applying them to crucial cases" (ibid., 15). According to the above principle or principles, the crucial choice which an investigator has to make is to select one theory among those available. Botha does this from the outset, by adhering to "the linguistic theory of Chomsky and his associates", because of its unique place in current linguistics and because of the "unusual degree of sophistication" which the discussion of "many linguistic questions" attains in this theory : in addition to the epistemological principle just referred to, the "second general view influencing the scientific activities of many modern linguists, in one way or another, is that in the past ten years the scene of international linguistics has been dominated by one particular linguistic theory : transformational generative grammar" (ibid., 13-14). While I would accept this "second general view" as a fact, Botha's consideration of TG theory as "a particular well-defined linguistic theory" is more questionable, even if allowance is made for Popper's principle. While Botha may have been correct in holding this view at the time he was preparing his dissertation, it seems that one could rather speak to-day of a deep crisis, if not a disintegration, of TG theory. Rather obvious evidence for my appraisal is provided in Bach and Harms's introduction to the proceedings of a symposium on TG theory, which was held at Austin in 1967 and which, it seems, was attended by the chief representatives of the younger generation of TG linguists :

> Toward the end of the conference, when it had become apparent that the general agreement did not encompass any currently explicitly formulated model, the question was raised : what should we be teaching our students ? Langendoen's answer seems to us most apt : we should give them the ability to recognize an interesting linguistic problem when they see one, that is, one which throws some light-negative or positive-on our conceptions of what languages in general are like . (Bach and Harms 1968, vi)

I do not wish, however, to quarrel about this but would rather raise two more fundamental questions by asking, first, how a linguist can know that he has to do with "a particular well-defined linguistic theory or model", and, secondly, what arguments can be advanced to uphold Botha's epistemological principle concerning the essential role of such a theory or model in linguistic investigation. I suggest the first question is best reduced to the second, and wish to turn to Botha for an answer, as I am not acquainted with better or other arguments than those he presents in his thesis.

In fairness to the author, I must quote him at length. As already noted, his argumentation is directed against the loose usage which some linguists make of terms like 'the sentence', and 'the word' of which Botha argues that they should only be used in the technical sense which they have in one particular linguistic theory. I quote Botha's passage in full, except for two titles (successively, 'Theory and Concept formation in Empirical Science', and '"The Word" and the Transformational Theory'), and for the footnotes, which merely provide a few additional references to the literature of epistemology on which Botha draws :

> the vocabulary of everyday speech does permit the formulation of certain generalisations, e.g., that wood floats on water, but that metal sinks in it, but these generalisations have important shortcomings. Firstly, their constituent terms will more often than not lack precision and uniformity of usage, causing their meaning to be imprecise and unclear. Secondly, many of these statements are of very limited scope, since they lack predictive power. Thirdly, these generalisations, e.g., 'All crows are black', usually either lack any explanatory power or have extremely weak explanatory power. Fourthly, heuristic power, i.e., the suggestion of further avenues of research, is not usually one of the attributes of generalisations presented in every-day terms and formulated in terms of non-technical concepts. To overcome these deficiencies and to attain its aims of description, prediction and explanation, empirical science has evolved, in its different branches, comprehensive and highly organised systems of special concepts, referred to by technical terms. Such systems are usually called "theories" and the concepts in terms of which they operate "theoretical concepts".
>
> The introduction of theoretical concepts is subject to two fundamental conditions. Firstly, they must have EMPIRICAL IMPORT (cf. Hempel 1952, p. 39), i.e. it must be possible to relate them indirectly and in a non-arbitrary way to the data they "account for", or "help to account for". Secondly, theoretical concepts must possess THEORETICAL or SYSTEMATIC IMPORT , i.e., they must permit the formulation of general explanatory and predictive principles. The notions 'theory', 'theoretical' or 'systematic import', and 'empirical import' can be further elucidated by the following metaphor of Hempel (1952, p. 36). He compares a scientific theory to a complex spatial network : "Its terms are represented by the knots, while the threads connecting the latter correspond, in part, to the definitions and, in part,

to the fundamental and derivative hypotheses included in the theory. The whole system floats, as it were, above the plain of observation and is anchored to it by rules of interpretation. These might be viewed as strings which are not part of the network but link certain points of the latter with specific places in the plain of observation. By virtue of those interpretive connections, the network can function as a scientific theory : from certain observational data, we may ascend, via an interpretive string, to some point in the theoretical network, thence proceed, via definitions and hypotheses, to other points, from which another interpretive string permits a descent to the plane of observation." The links existing between a theoretical concept and the (observational) data constitute its empirical import, while the "threads" linking it to the other theoretical concepts symbolise its theoretical or systematic import.

From this exposition, and especially from the metaphor, it follows that the content or interpretation of a particular theoretical concept C in a theory T is only partially, and in most cases indirectly, determined by the data to which it is related. C's interpretation or content can only be fully determined by taking into account also its relationships to the other theoretical concepts contained in T. As Braithwaite (1962, pp. 230-231) puts it "an understanding of a theoretical concept in a scientific theory is an understanding of the role which the theoretical term presenting it plays in the calculus expressing the theory...". Furthermore, from this view follows the corrollary that theoretical concepts "cannot be understood apart from the particular theory that implicitly defines them" (cf. Nagel 1961, p. 87). Let us now examine the cited criticism of Uhlenbeck, as well as his remedial suggestions, against this methodological background. Note that Uhlenbeck formulates his argument in a way to which the following expressions are crucial : "THE linguistic sign", "THE two basic units of language", "THE problem of the relationship between syntax and semantics", "THE unique position of THE word as a linguistic unit", "THE sentence", "sentence and WORD are correlative units". From this usage of terms, note especially the use of THE , and from the general trend of his argument it may be concluded that Uhlenbeck holds the opinion that in a certain sense concepts such as 'the linguistic sign', 'syntax', 'semantics', 'the word', 'the sentence' have an interpretation independent of any specific linguistic theory - he regards the insight that "sentence and word are correlative units" as "fundamental for any sound theory of language". That this view is untenable, follows from the generally accepted methodological principle that fruitful theoretical concepts can only have an interpretation within the framework of a particular theory.

Uhlenbeck not only loses sight of the principle that the empirical links existing between a theoretical concept and the data are mostly only indirect, determined therefore per theory, but he also disregards the principle of systematic import. If it were true that fruitful scientific concepts existed independently of and prior to particular theories the laborious efforts of scientists to construct intricate theories would be absurd and a waste of time and energy.

An alternative interpretation of Uhlenbeck's claim is that the concept of "the word" and "the sentence" as well as the relationship existing between them as formulated by Reichling in 1935 "is fundamental for any sound theory of language". This view is equally unacceptable when evaluated within the methodological framework outlined in the preceding paragraph. The so-called concepts "the word" and "the sentence" possess empirical and theoretical import only within the framework of Reichling's theory. One can interpret them only when they are regarded as theoretical constructs in terms of which this theory operates. It should be obvious that their interpretation is necessarily partly determined by the relationship existing between them and the other theoretical concepts in Reichling's theory, concepts such as 'taalsysteem', 'taalgebruik', 'uiteenplaatsbaarheid', 'volstrekte vormelijke bepaaldheid', 'semantisch aspect', etc. (cf. Reichling 1965, pp. 24-58). Thus, on account of their systematic import it is already impossible to use Reichling's concepts 'word' and 'sentence' in the transformational theory, or in any linguistic theory differing significantly from Reichling's theory. Note that even if the word concept used by transformationalists were to be formalised, it would not possess empirical and systematic import similar to that of Reichling's concept "the word".

Uhlenbeck has not come to grips with the idea that the problem concerning the relationship between syntax and semantics as discussed by Chomsky is only relevant to the transformational theory and that it can only be "solved" in the framework of this theory. Neither does he appreciate the fact that there exists no obvious basis for comparing theories of language whose aims are as disparate as those of his own and Chomsky's. (Botha 1968, 81-84).

I cannot help thinking that the whole of Botha's discussion on theories really amounts to a handful of well-known facts, which boil down to popular ideas about technical terms and related matters, and which, as far as linguistic theories are concerned, could have been more briefly formulated (and more interestingly, as I shall try to show in the next section) by resorting to the standard distinction between object-language and metalanguage, i.e. between the "language under observation and study", and "the language used by an observer for describing an observed object-language" (Cherry 1957, 305). What Botha says, then, can be put briefly as follows. Theories are set up to overcome the inadequacies of everyday language as a metalanguage. A theory is a metalanguage whose constituent concepts can only be understood in relation to the other concepts of the same theory, which "implicity" defines its concepts. Besides, the interpretation of theoretical concepts is determined by the theory itself, and "only partially, and in most cases indirectly" by the data, i.e. the object-language in the case of a linguistic theory. Consequently, metalinguistic concepts belonging to different theories, and each theory as a whole, are not reducible to one another. They can at best be compared when they have similar "aims".

In spite of his contention that he can demonstrate "obvious methodological flaws" (ibid., 13) in the argumentation of the scholars he criticizes, what Botha provides is not an argument, as the chief point he makes rests on a metaphor. There is nothing objectionable about analogies as a means of intellectual or other perception, on the contrary. But there is something ironical about a linguist like Botha (who adheres to a linguistic school with well-known requirements of form) having to present a metaphor as an argument. In fact, the irony does not stop there. Botha adheres to the TG theory of his time, and in particular to the semantic component of it as set up by Katz and his associates ; according to this theory, the meaning of lexical items is defined by means of a "universal" (i.e. language-independent) "theoretical vocabulary" of semantic "markers" (such as 'human', 'male', 'adult' and 'never-married', for the word *bachelor* : Katz and Postal 1964, 14) which are posited to be "a language-independent means of representing the common conceptual system underlying communication in natural languages" and to be "part of the cognitive structure of the human mind" (Katz 1967, 129). I cannot help detecting a contradiction here between Botha's theoretical and epistemological positions : between his acceptance of Katz's hypothesis about the *universal validity* of theoretical constructs like the semantic markers, and his insistence on the existence of sharply distinct theories *within the single discipline of linguistics* and on their being largely irreducible to one another. But the most significantly ironical aspect of Botha's discussion as far as this thesis is concerned is that his attempt to defend the use of TG theory as a single well-defined linguistic theory forces him to appeal to the very facts which this theory (and, for that matter, all the other linguistic theories) have left largely undiscussed : *conceptual* problems, problems of *discourse* structures, and their interrelations. Typically, for Botha a theory is something that 'hangs in the air' ; he nowhere speaks of theories in their linguistic manifestations as texts or discourses, and his recognition of the absence of reliable scientific knowledge on conceptual facts within TG theory is only indirect : "even if the word concept used by transformationalists were to be formalised". What one would at least have expected of Botha is explicit recognition that the metatheoretical position which parallels the well-structured theory of Chomsky 1965 to which he adheres (particularly its division into a syntactic, a semantic, and a phonological component) is basically indeterminate - as Chomsky himself most explicitly states :

> "In general, one should not expect to be able to delimit a large and complex domain before it has been thoroughly explored. A decision as to the boundary separating syntax and semantics (if there is one) is not a perequisite for theoretical and descriptive study of syntactic and semantic rules. On the contrary, the problem of delimitation will clearly remain open until these fields are much better understood than they are today. Exactly the same can be said about the boundary separating semantic systems from systems of knowledge and belief. That these seem to interpenetrate in obscure ways has long been noted. One can hardly achieve significant understanding of this matter in advance of a deep analysis of systems of semantic rules, on the one hand, and systems of belief, on the other"(Chomsky 1965, 159). More recently, Chomsky has noted that "it is not clear at all that it is possible to distinguish sharply between the contribution of grammar [i.e. linguistic theory] to the determination of meaning, and the contribution of so-called 'pragmatic considerations', questions of fact and belief and *context of utterance*" (my italics : Chomsky 1969a, 80). In connection with this opposition between 'pragmatics' and the study of abstract formal structures and relations, he further notes : "It may be that the next great advance in the study of language will require the forging of new intellectual tools that permit us to bring into consideration a variety of questions that have been cast into the waste-bin of 'pragmatics'" (*ibid*., 81).

These passages from Chomsky need to be quoted in connection with Botha's discussion since the question which they raise of what linguistic theory is about cannot be separated from the one raised by Botha about the role of a linguistic theory in achieving 'knowledge' about 'language'. Chomsky's remarks, as I read them, carry important suggestions in this connection. While leaving the question largely open for discussion they suggest that it is possible to assign a specific role to linguistic science, that linguistics cannot be equated with a 'general epistemology' dealing with all (aspects of) "systems of knowledge and belief" including itself, and that "a deep analysis of systems of belief" can throw light on the other issues.

Moreover, Chomsky's conception of the indeterminacy of current linguistic metatheory has a dimension beyond the suggestion that 'conceptual' systems ("systems of knowledge and belief") are relatable in some poorly understood way to the facts accounted for by the syntactic and semantic components of his theory. If all 'conceptual' systems display the same diversity and irreducible individuality as those manifested in the theoretical disagreements or differences of outlook among scientists, and linguists in particular (and there is no reason why this should not be the case), the question arises of how general a linguistic theory can be that incorporates conceptual facts other than its theoretical concepts, either by virtue of some form of metatheoretical indeterminacy, or as a result of some consciously made decision to incorporate them in linguistic descriptions. I shall return to these important questions in the course of this study, by providing an example of what can be done within a metatheoretical conception which is related to the way I have interpreted the above quotations from Chomsky.

Lastly, since Botha seems most knowledgeable about current work in logic, he might also have shown that the logicians are as helpless as the linguists about the problems of discourse and the related 'conceptual' problems, as Linsky suggests in the following passage about various types of discourses, and could also have done about scientific literatures and theories :

> In speaking about movies, plays, novels, dreams, legends, superstitions, make-believe, etc., our words may be thought of as occurring within the scope of special 'operators'. Let me explain. Watching the western, I say, "I thought the sheriff would hang the hero, but he didn't". The context in which these words are said makes it clear that they are occurring under the 'in-the-movie' operator (...) Similarly, I might say, 'Leopold Bloom lived in Dublin'. Is this true or false ? Obviously it depends upon

> whether my words are or are not, within the scope of the 'in-the-novel' operator (...) I am unable to explain what is at issue except in terms of the 'pictures' I have discussed. (Linsky 1967, 126-7).

I have quoted Botha, and carried out the discussion of his positions and justifications for them at somewhat tedious length because I wish to suggest that they point to an important generalization which Botha misses. The point I wish to make is this. To me, Botha and everybody else in linguistics or elsewhere, has failed to find real arguments that would justify the linguist's scientific activity as it is commonly pursued (and in particular the common practice of applying a single theory to one's data), and this failure suggests the need to recognize an alternative to Botha's "epistemological principle". Such an alternative would involve decisions more fundamental than those involved in Botha's and related positions, while it would seek to provide arguments justifying what seems intuitively sound about Botha's principle about the use of a (possibly single linguistic) theory in language analysis. The existence of such an alternative is suggested by the facts discussed in the preceding section concerning the content analysts' use of their social theories as a basis for setting up their semantic analyses, together with their indirect recognition of the need for a linguistic theory that would be suitable for their purpose. Such an alternative is discussed in the following section (1.1.4.), around the suggestion that all theories that are applied to natural language constitute metalanguages, and that the fundamental problem for the semanticist (and possibly for others) is to systematically relate object-languages to the relevant metalanguages, as well as to relate the constituent concepts of these metalanguages to each other explicitly, rather than be satisfied with the recognition of "implicit" relations between them, as Botha after Nagel apparently is.

Besides, this thesis will propose to give recognition to both the facts brought to light by the content analysts and others (the use of at least one non-linguistic theory in semantic analysis) and those discussed by Botha (the use of linguistic theory in linguistics), thus raising the problem of determining the respective roles of the two kinds of metalanguage in semantic analysis : the linguistic theory or theories or parts of them on the one hand, and the non-linguistic theories applied to linguistic data or the metalanguages drawn from these theories on the other. I shall return to this and to other problems in the outline of my metatheoretical positions presented in section 1.1.6. Here, I would merely point out that the concrete form in which the above problem will be raised in this thesis will consist of asking what are the respective roles of linguistic theory and of a kind of classification in a semantic analysis of English abstracts in the field of documentation.

1.1.4. Types of metalanguages, and problems of communication.

A metalanguage can be defined broadly as a language of "signs referring to signs", of "signs of signs", or perhaps more aptly as a language of symbols referring to symbols, if we wish to stress the "conventional" nature of metalanguage and object-language signs as well as of the "coordination" between the two (Reichenbach 1947, 9 and 4). Reichenbach illustrates the notion of metalanguage as follows: "Thus the word 'word' refers to signs ; so do the words 'sentence', 'clause', 'phrase', 'name'. We say that signs of signs constitute a language of a higher level, which we call metalanguage ; the ordinary language then is called object language" (ibid., 9). He also stresses the metalinguistic nature of definitions, by giving various paraphrases of a definition of 'submarine' : for instance, "the term 'submarine' is to have the same meaning as the term 'ship capable of going under water'" (ibid., 20). The interest of Reichenbach's general definition and illustrations for the present purpose is that they suggest the existence of various kinds of metalanguage. Some may occur in everyday language, by virtue of the general definition as "signs of signs" and also of the obvious, but poorly understood, fact that "the metalanguage is in the language", as when an English-speaking linguist uses English to describe English (see Harris 1968). Thus, next to the linguist's "observational statements" (Leech 1968), a host of everyday expressions such as various forms of paraphrases may be called at least partly metalinguistic : "informal judgments" such as "It was the same old story" (Stone et al. 1966, 4), or phrases such as "i.e. ...", "to put it more (+ some adverb) ...", etc. As Reichenbach notes, terms typically derived from grammatical theories such as 'sentence' and 'clause' are also metalinguistic, as are typically semantic statements such as definitions.

From what precedes, it follows that any symbolic system used to speak about natural language is by definition a metalanguage. This, then, is the case of linguistic theory, as well as of the systems of "categories" or "characteristics" which content analysts draw from their social theories to carry out their semantic analyses of texts. This is also the case of the various kinds of documentary languages set up and used by documentalists to represent the content of scientific documents, the best known form of these documentary languages being classification systems with words as entries. Perhaps the metalinguistic character of documentary languages and their entries appears most strikingly in these crudest forms of documentary analysis, as the differences between the object-language and the metalanguage conventions are then most apparent : when, for instance, one or a few words drawn from a classification or subject-heading list serve to characterize the meaning of a whole book.

What has been said so far raises two main questions. One is whether the distinction between object-language and metalanguage is necessary and how it can be justified. The other is whether various types of metalanguages can be distinguished, if the rather heterogeneous facts exemplified above are not to be lumped together under the general category of metalanguage. These questions, as well as Reichenbach's definition, can be clarified by referring to Cherry (1957, 305). Cherry defines a metalanguage as "observer's language" or as "the language used by an observer for describing an observed object-language". Moreover, and most importantly, he relates his distinction to a communication process by distinguishing between an "external observer" who is "quite detached from the communication event he is observing" and a "participant observer" who "reports upon communication events in which he is one partner".

The first question, on how to justify the distinction between object-language and metalanguage, can be answered on the basis of Cherry's definition. It is simply a *fact* that people can act as object-language users *and* as language observers, and that their symbolic conventions in the latter role differ from those in the former. Until the difference can be specified scientifically, in linguistic science or otherwise, the distinction under discussion must rest on observations such as Botha's on the existence of, and differences between, linguistic theories, and between these and everyday language, or other observations such as: Stone and his team have set up and used the *Harvard III Psychosociological Dictionary* and others (listed in Stone *et al*. 1966, 140) as metalanguages for content analysis ; Lawlor and his team have set up a list of 68 definitions and draw from this metalanguage for documentary analysis to characterize "involuntary confession cases" in American law court decisions; etc. The distinction is also based, as far as semantic analysis is concerned, on well-known "semantic anomalies" which exist in any natural language (NL) :

> *a*) different NL terms are held as equivalents (*synonymy*); *b*) to a single NL term are bound several meanings (*homonymy*, *homography*, *polysemy*, etc ., *e.g.*,"circulation", traffic, blood, money, libraries, etc.); *c*) different syntactic turns of phrase are held as equivalent in regard to the underlying logical relationship (*allotaxies*, *e.g.*, "actions of *x* on *y*", "role of *x* in *y*", "*y* is affected, influenced, etc., by *x*",etc.); *d*) a specific phrase-structure in NL may convey different logical relationships (*homotaxies* ; noun-noun which may sometimes qualify, "lung cancer", and sometimes be causal, "tobacco cancer", etc.) ; *e*) more complex equivalences are set forth between words and phrases of a single language (*definitions*, *e.g.*, "hypothermia", "a temperature lower than normal", etc.). (Gardin 1969, 20)

Again in Gardin's words, the recognition of such facts suffices for "the postulation of a reality of symbolic systems outside the natural languages under consideration" (*ibid*., 21), and therefore different from them - to an extent to be investigated :

> To say that, in a given field of observation, x and y will be held equivalent to each other, for example "clock" and "timepiece", is to refer implicitly or explicitly to a metalinguistic entity, which is made to correspond to the x and y of the NL under consideration. It makes no difference if this entity borrows its name from that same NL, since the only important thing is its definition (...) It often happens that a given NL vocabulary does not provide any suitable term for this or that entity of the metalanguage. The same reasoning holds in inverse cases of lexical dissimilation (a single NL term made to correspond with several distinct entities, each designated by a different symbol of the metalanguage) [and also of] the syntactic phenomena noted above, under the headings of allotaxies and homotaxies (...) If, for instance, one establishes an equivalence between locutions like "effect of x on y", "the role of x in y", "y is affected by x", etc., it implies the definition of a corresponding syntactic unit in the metalanguage of the analysis, however one chooses to express it. (ibid., 22)

As will be noted, Gardin's points throw light on Harris's statement that "the metalanguage is in the language". First, the theoretically important qualification needs to be made that the units appropriate to name a metalinguistic entity are not always available in the object-language considered. Second, there is no contradiction between the distinction under discussion and Harris's observation : both 'the language' (say, English) and the metalanguages (based on English) are just facts. The problem is simply how they relate to each other.

One further important aspect of metalanguages to be stressed here, which provides further justification for the distinction under examination, is that metalanguages can - to a point which research will have to establish - be described as 'languages'. I use the term language informally to suggest the need to analyze metalanguages as wholes. This point, as far as I can see, has received more illuminating attention in the field of documentation than elsewhere, particularly with Coyaud 1966. I shall return to the problem later, from a rather different perspective from Coyaud's, namely the individuality or distinctive nature of metalanguages in documentation, as it could be described on the basis of a linguistic theory. Here, I would just say that my metatheoretical position in this respect is similar to that adopted by Botha in connection with the differences between linguistic theories : the differences between documentary languages, as I shall argue below, is a basic fact about them which needs accounting for. Besides, possibilities of converting one documentary language in a given field into another in the same field can be investigated, and in fact have been, as I shall point out later. In particular in Part III of this thesis, I shall try to substantiate the view that linguistic theory can serve to describe a documentary language distinctively, i.e. as representing what is distinctive about the corresponding 'universe of discourse' or 'field' of the objec-language, and that the kind of structural discussion of documentary languages given by Coyaud on the basis of a theory or model in the field of documentation (SYNTOL : Cros et al. 1964) can also be usefully attempted on the basis of recent developments in linguistic semantics.

To take this discussion a step further, I propose that Cherry's definition and his reference to a communication process can serve as a basis to distinguish various types of metalanguages, by suggesting a relation between the metalanguage used and the type of observer, as well as the need to distinguish between a "detached" observer and one who participates in the communication events he is observing. Before I can attempt to distinguish various types of metalanguages, however, one preliminary point needs to be made. The relation I establish here, after Cherry, between the notion of metalanguage and the process of communication does not result from any commitment to philosophical controversies about the role of communication in the attainment of 'knowledge about language'. I do not wish, either to "dogmatically" defend this role (as Strawson admits, he does: Strawson 1950, 32) *or* to adhere to the opposite view (as recently expounded after Chomsky by Moravscik 1957). My position in this respect simply consists of accepting as a fact the documentalists' conception and practice of semantic analysis as an approach to communication between writers and readers of scientific texts. Such a position simply consists of giving recognition to the fact that, irrespective of philosophical controversies and scientific formulations of the process, documentalists semantically analyse texts by assigning them metalinguistic representations that are intended to be used by the users of libraries (documentation centres, etc.) to formulate questions (search requests, as they are sometimes called) which will give them access to the documents stored in the library and to the information contained in these documents. The advantage, I would argue, of giving recognition to this fact is that it is a fact that can be observed and investigated in a concrete communication situation which is natural in the sense that addressors and addressees are distinct, unlike in the 'class-room' situations commonly investigated by linguists. The fact that I have not been able, for practical reasons, to test my semantic analyses does not affect the general point I am making here. In the course of the present metatheoretical discussion, I shall present the adjustments of Chomsky's competence/performance distinction which I believe to be required by a recognition of the documentalists' approach to semantic analysis, and of the general fact of communication underlying it.

The first distinction between types of metalanguages which I wish to put forward on the basis of Cherry's definition is one between what might be called *private* and *public* metalanguages. An example of a private metalanguage is suggested by Botha's discussion : imagine, for instance, a linguist who would use terms such as 'the sentence' in his own way, without referring to the use of such terms in an existing theory. Examples of public metalanguages are : linguistic theories, the sets of "categories" used by content analysts in their semantic analyses, and the documentary languages such as classification systems set up by documentalists and used in libraries and documentation centres for purposes of scientific communication. I shall show later that the kind of classification system used in this thesis meets the description of a public metalanguage in both respects : in terms of the way it was set up, and of the use for which it was destined. The following is evidence for regarding the content analysts' categories as similarly public, in the sense that they rest on agreement or consensus between the members of the research teams that set them up :

> Suppose we want to identify the extent to which "conservatism" is expressed in writing or speech. Investigators would undoubtedly differ in their intuitive interpretations of the meaning of this concept (...) However, by thinking about and discussing the different aspects of the concept, they might well agree on characteristics they would consider signs of conservatism. (Stone *et al*. 1966, 7).

A second distinction I wish to propose is between metalanguages set up to account for the *communicative* function of object-languages and those which appear not to be set up for this purpose in view of the fact that they reflect a "detached observer"'s point of view. In order to explain this distinction, it seems necessary to posit that a consideration of the communicative function of language imposes *a distinctiveness requirement* on semantic analysis. This assumption can be put differently as follows : in order to account for the communicative function of language, a semantic analysis must state what is distinctive about meanings in the object-language and its manifestations.

I personally am inclined to regard the above assumption as a truism. It needs to be stated, however, because the facts which underlie it do not seem to be generally recognized. The point as I wish to put it can be illustrated as follows : in a communication situation in which the addressor uses an object-language (say, an utterance in chemical English) which the addressee (say, a four-year-old child) doesn't know, the addressee will be unable to state what is distinctive about the meaning of the utterance in question ; he can (at best) give a vague and incorrect semantic analysis of it (cfr. various discussions of Harris 1968 quoted below).

The above position raises the question, which is crucial in the present study, of how to select a metalanguage meeting the distinctiveness requirement in question, how this metalanguage is set up, and where it can be found. The problem may be put as follows : does there exist a theory that would provide a suitable metalanguage, or criteria for selecting one, and for selecting an object-language ; if not, how can the problem be solved metatheoretically.

In order to answer these questions, I submit the third distinction I wish to make between metalanguages : a distinction between metalanguages set up to account for the communicative function of language in the whole of a language and possibly in all natural languages, and field-specific metalanguages, which are set up and can be used directly by a type of "participant observer" : for instance, a physicist observing the language of physics, or an expert of everyday life observing everyday language, as in the case of everyday language philosophers and linguists.

As the last point is intended to suggest, I propose that an examination of the problems under discussion is obscured by the common practice among linguists and other students of language to concentrate on everyday language. The problems are obscured because in a linguistic study of everyday language, the linguist accidentally plays two roles : that of a linguist-observer and that of an expert who is acquainted with what Chomsky calls "the systems of knowledge and belief" of the field he deals with, or, more briefly, with a given culture. The present study of a non-everyday variety of English and the notion of field-specific metalanguage are intended to put an end to this confusion. Besides, this notion of field-specific metalanguage has the advantage of reducing 'cultural' facts which underlie the use of the word field (or such logically oriented notions as universe of discourse) to a researchable form. What remains to be seen is whether this notion is necessary, in particular whether a linguistic theory could not provide a field-specific metalanguage that would serve the same distinctiveness requirements as those served by a field-specific metalanguage. The answer proposed in this thesis is no, and the arguments provided for it are of two kinds : first, factual arguments about the absence of a metalanguage in linguistics for the field under investigation (documentation), about the existence of several metalanguages for different fields and even for a single one (such as documentation : in this, my position is analogous to Botha's on linguistic theories), and about the impossibility of reducing the existing metalanguages to ONE field-independent AND distinctive metalanguage; second, the definition of the role to be assigned to a linguistic theory allowing a place to the communicative function of language.

Concretely, the semantic metatheory proposed here after Gardin will result in using, and in determining the interactions of two 'metalanguages' (This will be discussed below, in section 1.1.6.). One is a 'public', and 'field-specific' metalanguage set up for communication purposes : a kind of classification system for documentation, the field under investigation. The other is similarly a public metalanguage namely a form of linguistic theory of which I shall argue that it can serve to meet the distinctiveness and communication requirements discusses above, and can ideally do this for a language as a whole.

As will be noted, an important consequence follows from the metatheoretical position delineated above after Gardin 1969 and the content analysis. The generally acknowledged absence of any adequate linguistic theory for semantic analysis of texts is of no consequence as far as the availability of a 'public' and field-specific metalanguage is concerned, and a linguistic theory cannot provide such a metalanguage in any case. In this respect, then, the present semantic study of abstracts in the field of documentation can proceed in the same way as, say, a study in syntax which draws the needed metalinguistic entities from a public metalanguage (a syntactic theory). The problem in this study is similarly one of applying and adjusting as explicitly as possible a finite inventory of metalinguistic categories and relations to the indefinite number of possible texts in documentation English, on the basis of a finite number of observations (cp. Chomsky 1965 on the competence/performance distinction, to be discussed below).

That linguistic theory does not provide a metalanguage such as that found in a classification system for the field of documentation hardly needs to be shown ; what I wish to further argue here, however, is that it is similarly unable to provide criteria for choosing one or the best one, for selecting the object-language, or for defining what I would call observational happiness (or appropriateness) conditions, that is for determining whether or to what extent a given metalanguage and a given object-language are compatible. In order to show this, I must turn to a point of linguistic theory. After Austin 1962, researchers such as Harris (1968) and Ross (1970) have posited, and investigated the structure of, what may be called 'implicit performatives'. Sentences such as "I sentence you to two weeks' imprisonment", "have, instead of truth values, various conditions pertaining to appropriateness of use" (Ross 1970, 222), as Austin had noted : "I", for instance, needs to be some kind of judge if the sentence is to be appropriate. By analogy with such sentences, linguistic evidence has been found to suggest that any declarative sentence is, structurally speaking, a clause functioning as a complement in a sentence of the type "I say to you ...". What I wish to argue, assuming that the above hypothesis is correct, is that linguistic theory is unable to specify the 'correct' identity of the "I" and of the "you", the participants in the communication process. The status of the you, in particular, seldom shows up in actual linguistic utterances, as it does in some book titles, when some appropriate specification is expressed about the status of the reader : cp., say, "Microbiology", "Advanced microbiology", "*Advanced microbiology for the elementary school". As the status of the addressee, and therefore of the observer, and of the addressor, cannot be specified by linguistic theory, it follows that, linguistically, all possibilities are open, including some that seem intuitively incompatible with the communicative function of a given utterance. To take the example of the documentation abstracts under investigation in this thesis, a linguistic theory cannot rule out the possibility of having as addressors and addressees, say, four-year-old children, janitors, aged theologians, etc : a novelist, for instance could actually do this, but what is claimed here is that the suitable metalanguage for describing his novel would have little to do with a metalanguage used by documentalists.

If I am correct, the only basis for selecting the object-language and the metalanguage is the one adopted in this thesis. For the choice of the object-language, I rely on experts (Janaske and his team : Janaske 1962) who have stated that their bibliography of abstracts deals with documentation" or rather with "*science information*" and with various other metalinguistic entities given in the preface to their bibliography (see chapter 1.2., below). Similarly, I have chosen as a metalanguage a kind of classification system set up by its editors and their co-workers for the field of "*scientific information*" (N. Gardin and Lévy). My choice, then, of the object-language (or rather of its manifestations, in the abstracts of the Janaske bibliography) and of the classification used as a field-specific metalanguage rests basically on the hypothesis that in the two above judgments (Janaske's and N. Gardin's) the terms "scientific information" and "science information" are equivalent. The linguistic problem, I would argue, begins at the point where one attempts to account for the relations between such metalinguistic entities as "science/scientific information" and others corresponding to them, such as the entries of the classification system, *and* for the relations that are empirically establishable between these metalinguistic entities and the abstracts under investigation : when, for instance, one can say that a given abstract "deals with" a given classification entry.

Linguistic theory, then, cannot set up or select a metalanguage for the field of documentation, simply because the establishment of the "systems of knowledge and belief" belonging to this field (or to any other) lies outside the linguists' responsibility and competence. Similarly, linguistic theory cannot establish to what extent a metalanguage for this field is 'appropriate' as this can only be done by one or more experts of the field ; it cannot, for instance, establish the adequacy or inadequacy of the following definition of documentation :

> the assembling, coding and disseminating of recorded knowledge comprehensively treated as an integral procedure utilizing semantics, psychological and mechanical aids, and techniques of reproduction including microcopy, for giving documentary information maximum accessibility and usability. (Webster's Third New International Dictionary, 1967).

Nor can linguistic theory specify which metalinguistic entities or concepts are 'primitive' or 'basic'. As Fillmore has put it, for a linguist to decide that 'human', 'parent", 'female','born', 'married', for instance, are "semantic primitives" is to define them in terms of (his or somebody else's beliefs about) "phenomena of the real world" rather than of "other linguistic concepts" (Fillmore, 1968c, 34), and I argue that a linguistic theory provides no basis for such a decision. Similarly, and again after an example from Fillmore, I suggest that linguistic theory does not set a "stopping place" at which one can be sure that one has stated 'all' the "selectional" components or features assignable to a word (say the wolf) in order to specify the words that can appropriately be used with it in a sentence : e.g. ate in the wolf ate, where wolf would be assigned a feature 'animal' selecting ate and the like (Fillmore 1969b, 93).

More importantly, I argue, after Bolinger's criticism of Katz and Fodor 1953, that a distinction between "knowledge of the language" and "knowledge of the world" (and similar ones) is metatheoretical and that any attempt to give it a foundation in linguistic theory is misguided and can only be arbitrary. This I also believe to be the case of the type of position mentioned above in connection with Leech, where the theory acts as a filter : anything that is theoretically untractable or incompatible with criteria internal to the theory is 'filtered out' as lying outside the scope of linguistics ("linguistic competence").

> To return to Katz and Fodor, it will be remembered (1953, 178) that they illustrate the dichotomy "knowledge of the language" versus "knowledge of the world" by claiming that, unlike the concepts expressed by semantic markers such as (Male) and (Female), the information enabling us to understand horse shoes (or rather horseshoes, as Bolinger points out) as shoes for horses and alligator shoes as shoes made from alligator skin belongs to our knowledge of the world and must therefore be excluded from the theory. With Bolinger, I suggest that Katz and Fodor are doubly wrong : "Where do markers like (Animal), (Physical Object), (Young), and (Female) come from if not from our knowledge of the world ?" AND "What is strange about (Shoe-wearing) as a semantic marker-not as general, surely, as (Female), but general enough?" (Bolinger 1965, 568).

Similarly, even if a "feature" such as 'human' can be shown to have syntactic relevance in English - for instance, to account for who (Chomsky 1965, 150) - (but not for the French qui), its nature, I would argue, is no more linguistic than, say, that of 'Shoe-wearing'. In brief, I hypothesize that all in language is conceptual, and that all the conceptual facts are needed to explain 'linguistic structure' at some points or other. Arguments for this view are beginning to appear in the linguistic literature. Next to analyses of scientific English by Harris, which are referred to in this thesis, there are various analyses by Fillmore : he shows, for instance, that an account of she even reads Sanskrit requires the incorporation of some "surprise" factor

(Fillmore 1965). Let me also mention two recent papers, one by Green (1968) and one by R. Lakoff (1970) :

> Green examines English sentences with the emphatic particles either and too. She shows that for a whole range of such sentences the occurrence of these particles can only be accounted for on the basis of conceptual facts and she develops an interesting notion of implicit predication in this connection ; Green's formulation of the corresponding syntactic structures and her discussion of intonation can be omitted here. As she notes, the sentence Ho Chi Minh is responsible for a lot of deaths, and LBJ (President Johnson) is no saint either "implies that Ho Chi Minh is no saint". Similarly, Barb is seventeen, and Wendy is old enough to have a driver's license too "implies that seventeen, and therefore Barb, is old enough to have a driver's license". (Green 1968, 24). In some cases, the agreement between the two clauses can be described as "affective" : "when such sentences as He's a pacifist, and he paints well, too are acceptable, pacifist must be taken as connoting a positive attribute in the mind of the speaker if paints well is" (ibid., 28). In her conclusion, Green suggests that the syntactic component of TG grammars "will have to operate in terms of semantic representations, and will have to be sensitive to the speaker's "conception of reality" and his conception of relations between his concepts to a greater extent, and for more reasons, than has been assumed up to now" (ibid., 34). A similar point has been made more recently by Robin Lakoff (1970), in a paper which will be discussed in Part III.

Before I can turn to the question of the linguist's "neutrality" (in the next section, 1.1.5.) and outline my metatheoretical proposals (in the following section : 1.1.6.), I also wish to show that the distinctions just made after Cherry can throw light on a few other general issues. First of all, I suggest that the distinction between private and public metalanguages and the emphasis on communication can capture the facts underlying various parallel distinctions. One of them is Gardin's opposition between predetermined metalanguages and others : he speaks of metalanguages defined "a priori", such as classifications or the content analysts' "categories" (Gardin 1969, 26). The distinction I put forward can also throw light on another opposition, which may be difficult to base on observable facts. I am thinking of a distinction between 'inductively' and 'deductively' established metalanguages and in particular of Bach's discussion of linguistic theories in terms of the advantages of "hypothesis-making" or the "Keplerian" attainment of knowledge about language, as opposed to the "Baconian" (Bach 1965).

Secondly, the distinctions I propose can be used to characterize the type of semantic theory made explicit by Katz and his associates, and to refute some claims made by these authors:

> Consider the claims they make about the elementary metalinguistic terms (the semantic markers) which they set up. The semantic marker is a central notion since the basic hypothesis is that the theory establishes the meaning(s) of any (deep structural representation of a) sentence "compositionally", that is by amalgamating the semantic markers for the smallest units (lexical items, or, better, entries) with each other, and by deleting markers that are inappropriate (such as 'Social Activity' for ball in The man hit the colorful ball), until the meanings of the larger sentence constituents and eventually of the whole sentence are established. What I wish to suggest first is that Katz and his associates wrongly grant their semantic markers a theoretical status similar to that of syntactic markers when they claim that"a semantic marker is a theoretical construct (...); it is on a par with such scientific constructs as the atom, the gene, valence, and the noun phrase. A marker like (Human) or (Color) is, then, not an English word, but a construct represented by one" (Katz and Fodor 1963, 208). I would argue, on the contrary, the following : (a) When they establish semantic markers such as (Social Activity) and (Physical Object) for ball, they do this irrespective of the very communication process which their theory claims to account for (Katz and Fodor 1963, 198 on ball; Katz 1967, 129, presents the vocabulary of markers as "a language-independent means of representing the common conceptual system underlying communication in natural languages"). In particular, the semantic markers

are established by observing *words* rather than units with which people communicate : utterances, or their grammatical representation as sentences. In other words, Katz and his associates are "detached observers" in Cherry's sense. Langendoen (1967) has made a similar point about the "detached linguist-observer" reading ambiguities into sentences, such as 'Social Activity' for *ball* in *The man hit the ball*. In a different context, Lyons has stressed the *primacy* of implications between sentences in a communication process, and the *derived* nature of such entities as the semantic marker. Perhaps the validity of Lyons's point and, more generally, Katz and his associates' 'detachment' from facts of communication are best shown negatively. Katz and Fodor's central hypothesis is that it is possible to set up a theory of semantic interpretation of sentences *in isolation*, and that the particular interpretation(s) ("reading(s)") of a sentence are determined by the "selective effect of setting" (i.e. of sentence context). This position, it should be stressed, is *different* from the common *practice* which consists of dealing semantically with grammatically defined material such as sentences AS IF all about their meanings were statable in terms of sentence-internal facts. What Katz and Fodor claim is that such a practice can be turned into a fundamental principle of the theory or metatheory : since "the readings that a speaker gives a sentence in setting are a selection from those the sentence has in isolation, a theory of semantic interpretation is logically prior to a theory of the selective effect of setting" (Katz and Fodor 1963, 178). The difficulty with such a position, I submit, is the following : one is supposed to be able to establish the meanings of sentence constituents (in the form of semantic markers) and to predict "sentence readings" *without* appealing to the very factors assumed to determine these "readings" : sentence "setting" or context, and, beyond it, an observable communication situation.

(b) Katz and his associates' representations of lexical items by semantic markers can be described as drawn from a private and 'non-field-specific' metalanguage. This point equally applies to similar proposals made after Katz and associates or later : e.g. Leech's notion of "components". The only passage known to me that throws some light on the way in which Katz and his associates establish their semantic markers is the following : "A semantic marker is a theoretical term that designates a class of equivalent concepts or ideas. Consider the idea each of us thinks of as part of the meaning of the words 'chair', 'stone', 'man', 'building', 'planet', etc. but not part of the meaning of such words as 'truth', 'togetherness', 'feeling', 'shadow', 'integer', 'departure', etc. - the idea that we take to express what is common to the meaning of the words in the former group and that we use to conceptually distinguish them from those in the latter. Roughly, we might characterize what is common to our individual ideas as the notion of a spatially and temporally contiguous material thing. The semantic marker (Physical Object) is introduced to designate that notion. It provides a means of expressing the generalization that the words in the former group are semantically similar in this conceptual respect whereas they differ in meaning from the words in the latter group in the same respect. Such generalizations are expressed by including this semantic marker in the lexical readings for the words in the former group and excluding it from the lexical readings for those in the latter". (Katz 1967, 129-130) Rather than point out (as might reasonably be done) on the basis of what precedes that Katz's semantic markers are established inductively (as Bach might say) or a posteriori (as Gardin would say), I would argue that Katz and Fodor incorrectly grant the same "theoretical" status to syntactic and semantic markers and that there is a fundamental difference between the two. A syntactic marker such as the noun-phrase is rightly called theoretical because it is drawn from the metalanguage of a scientific community : the one which has set up and uses a certain type of TG theory. The semantic markers, on the other hand, are more rightly described as belonging to a private metalanguage of Katz's, and his selection of the object language (the words 'chair', etc.) as equally idiosyncratic. This is even more obviously the case with "the notion of a spatially and temporally contiguous material thing", of which the marker (Physical Object) is only a shorthand notation : the above quotation can only be adequately described as Katz's private symbol for his own conception of such notions as 'space', 'time', etc., and their interrelations, and in terms of Katz's views on the applicability of this private symbol to such object-language words as 'chair', etc. Besides, the only communication process involved in the above passage is Katz's appeal to the readers' consensus : "Consider the idea each of us thinks of as part of". In this respect, it is arguable that, unlike semantic markers, dictionary definitions (however informal they may be) constitute a truly public metalanguage since people regard them as expressing the lexicological norm or norms shared by members of the linguistic community or communities.

The above characterization of semantic markers as part of a private metalanguage of the authors who set them up is intended to be more than a criticism of Katz and his associates. The point is really this: *nobody, to my knowledge, has been able to do better than Katz and associates as far as componential analysis of words is concerned*. This points to a problem which I shall attempt to clarify in this thesis, namely the following *paradoxical situation* : while *non-linguists* are able to set up 'public' metalanguages (classifications and the like) for semantic analysis of *texts* in a particular *field*, *linguists* have been unable to set up more than 'private' metalanguages for semantic analysis of other, 'smaller', types of language units such as the sentence or the word - whether they concentrate on a 'field' or claim to provide componential analyses valid for the 'whole of the language'. The only way out, as far as I can see, lies in demonstrating that Lyons is correct when he insists that componential statements are *derived* from other, more basic, statements (such as those made in terms of the truly *theoretical* notion of implication 'relation', discussed below)and describes componential analysis as merely a "technique for the economical statement of certain semantic relations between lexical items *and* between sentences containing them" (Lyons 1968, 476). More broadly, the solution lies in a 'structural' approach to semantics such as that advocated by Lyons and others, as I shall argue below in section 1.3.3.

Lastly, Katz's phrases "*each of us*" and "the idea that *we* take to..." in the above quotation embody their well-known claim that semantic markers constitute a "universal theoretical vocabulary" which is "part of the cognitive structure of the human mind" (Katz 1967, 129). This claim is best discussed in the next section, as one among other philosophical speculations about meaning in natural language. The linguist, as I shall argue after Lyons, should be neutral towards these, especially when they are in contradiction with certain facts to which he can give recognition - as is the case for the practical impossibility of reducing all existing metalanguages for a given language or for all languages to a single, 'universal' metalanguage. It should be noted, however, that the claim about the linguistic irrelevance of speculations concerning a universal semantic vocabulary is closely tied to the empirical emphasis on the central place of communication in linguistics, as a recent and most extreme pronouncement by Pottier suggests : "'Pure' linguistics is dead". The general suggestion is that linguistics, and in particular lexicology, should turn - like sociology and many literary studies - to the investigation of small, "homogeneous" groups of people, because lexicologists should concern themselves with varieties of a language "that actually function" (Pottier 1968). Any other type of lexicological study can merely reflect the personal views of one "detached linguist-observer".

1.1.5. The linguist's neutrality.

According to a position most explicitly formulated by Lyons 1968, the linguist and in particular the semanticist can adopt a neutral attitude towards a number of philosophical and psychological speculations or controversies about the 'nature of meaning'. As I shall argue, also after Lyons, such an attitude goes together with a theoretical conception of semantics discussed below under the heading 'structural semantics' (1.3.3). Here, I wish to deal with the first point, and to suggest why the kind of neutrality advocated by Lyons can and even should be adopted in the present thesis. In keeping with the topic of this thesis, I shall draw not only on the linguistic literature but also on some sources in the field of documentation.

One philosophical controversy about which I shall avoid philosophical commitment is that between 'nominalists' and 'realists' :

> Have the things to which we apply the same name, some common 'essential' properties by which we can identify them (as the 'realists' might say) or have they nothing in common other than the name that by convention we have learned to apply to them (as the nominalist might say)? (Lyons 1968, 401)

My position in this respect has been stated in the preceding section : it simply consists of recognizing the existence of certain metalinguistic symbolic conventions as a fact worthy of research; this position, I claim, has nothing to do with the realist/nominalist controversy as such - i.e. as an object of century-long debates among philosophers.

Another philosophical controversy about which I shall avoid philosophical commitment is the distinction between "synthetic" and "analytic" statements :

> This distinction may be put as follows : a synthetic statement is one which is true 'contingently' - as a matter of empirical fact which might have been otherwise; an analytic statement is one that is 'necessarily' true, and its truth is guaranteed by (i) the sense of its constituent elements and (ii) the syntactical rules of the language. To take a standard example : the sentence *All bachelors are unmarried* might be regarded as analytic on the grounds that *bachelor* and *unmarried* are semantically-related in such a way that the truth of the sentence is guaranteed (...) the semantic analysis of language as it is used in everyday discourse need not wait upon the solution of the philosophical problems attaching to the distinction between contingent and necessary truth. What the linguist requires is a pragmatic concept of analyticity. (*ibid.*, 445)

The kind of claim which Saussure makes when, for instance, *la terre tourne* is considered as belonging to *langue* (Saussure 1968, 173) should be qualified in the light of Lyons's points. The same is true, I believe, of Chomsky's so-called "mentalistic" conception of linguistic knowledge or "competence", as an ability "intrinsic" to the speaker-hearer, i.e. as "a mental reality" underlying linguistic behaviour (Chomsky 1965, 4). Typically, such a distinguished epistemologist as Piaget, who accepts the central place of Chomsky's (and Harris's) *theory* in present-day linguistics, is reluctant to follow him in his speculations about "innate" ideas and would rather accept positions advanced by Saumjan in this respect (on the basis of psychological and other evidence : Piaget 1968, 77-8).

Similarly, I do not wish to commit myself to the various other forms of competing philosophical attitudes, from those that underlie Firth's (1964) and Bloomfield's (1933) conceptions of meaning to those of Malinowski. Malinowski's conceptions are particularly worth mentioning here because they embody precisely the kind of philosophical commitments which I wish to avoid, while they are otherwise very close to my own metatheoretical proposals. As a recent monograph has noted, (Langendoen 1968), there is a strange mixture of "important true insight" and gratuitous nonsense in Malinowski's presentation of his famous speculations that "even literary and scientific language is not the expression of thought, but its meaning is also given by correlation with the context of situation"; Malinowski writes:

> And it seems to me that, even in the most abstract and theoretical aspects of human thought and verbal usage, the real understanding of words is always ultimately derived from active experience of those aspects of reality to which the words belong. The chemist or the physicist understands the meaning of his most abstract concepts ultimately on the basis of his acquaintance with chemical and physical processes in the laboratory. Even the pure mathematician, dealing with that most useless and arrogant branch of his learning, the theory of numbers, has probably had some experience of counting his pennies and shillings or his boots and buns. In short, there is no science whose conceptual, hence verbal, outfit is not ultimately derived from the practical handling of matter. I am laying considerable stress on this because, in one of my previous writings, I opposed civilised and scientific to primitive speech, and argued as if the theoretical uses of words in modern philosophic and scientific writing were completely detached from their pragmatic sources. This was an error, and a serious error at that. Between the savage use of words and the most abstract and theoretical one there is only a difference of degree. Ultimately all the meaning of all words is derived from bodily experience. (quoted by Langendoen 1968, 34)

I can now turn to what I feel to be the philosophical speculation most relevant to the linguist's business, namely "the alleged universality of semantic components" (Lyons 1968, 472-5) just referred to in connection with the claims made by Katz and his associates about their "semantic markers", and other similar claims. As Lyons notes, it "has frequently been suggested that the vocabularies of all human languages can be analysed, either totally or partially, in terms of a finite set of semantic components which are themselves independent of the particular semantic structure of any given language" (ibid.). Cherry, for instance, discusses at some length the proposals made in this connection by such authors as Leibnitz, Descartes, Dalgarno, Bacon, Spencer, Ampère, and others (Cherry 1957, 37-38 and 228). While Katz and his associates have concentrated on such problems, Chomsky's contribution in this respect is limited to a few general assumptions which he leaves unexplored : for instance, "that the color words of any language must subdivide the color spectrum into continuous segments; or the condition that artifacts are defined in terms of certain human goals, needs, and functions instead of solely in terms of physical qualities" (Chomsky 1965, 29). In this connection, it may be interesting to refer briefly to the work of Leech, not so much because his is the only notable study of English (next to those of Katz and associates) in terms of semantic components, but especially because his work embodies a metatheoretical shift directly relevant to the present discussion. In a study of advertising English published in 1966, Leech states that to "describe the English of advertising is to say what is distinctive about it : that is, how it differs from other 'Englishes'" and that only a "brief consideration of regional and national differences is enough to dispose of the myth of the English language as a total, invariant system of rules" (Leech 1966, 67-8). In 1969, however, Leech outlines a "semantics of English"in which, he argues, "each particular descriptive problem" must be (i) "related to a general semantic theory", (ii) "to other 'semantic fields' within the same language, so that features of meaning may be generalised to the language as a whole", and (iii) "to the relevant lexico-grammatical structures, so as to form part of an integrated total description of the language" (Leech 1969, v). I suggest that the dilemna between "distinctive" and "total" description of the language can be clarified by distinguishing those aspects of it that are, or can be, a matter open to research in semantic or linguistic theory from those that fall within the realm of philosophical speculations - were it only because they are in contradiction with available facts. Under this view, I suggest that there is no conflict between the distinctiveness requirements as discussed in the preceding section and such attempts as have been made by Leech 1969 and others to "generalize" questions like 'Time', 'Place', and 'Modality' in English "to the language as a whole". What I wish to point out, however, is that the universality of semantic markers or components, and their validity for the whole of a language, as well as the fiction of a universal semantic language, however interesting it may be, are still a matter of philosophical speculation : "such empirical evidence as there is available at the present time would tend to refute, rather than confirm, this hypothesis" (Lyons 1968, 473). The evidence is particularly clear in the field of documentation. In this field, the structural unity of the vocabulary of "universal" classifications has to my knowledge never been shown, on the contrary (Coyaud 1966). As I shall show below in connection with the field of the abstracts under investigation in this thesis, the problem is rather the diversity of existing documentary languages or classifications, even in a single field. A similar diversity appears in the existence of various documentary languages serving as metalanguages for the various scientific disciplines and in the practical impossibility of reducing them to a cross-disciplinary scheme, or again, in the commonly accepted differences between competing linguistic theories, as usual practices in current linguistic research show (Botha). In the same fashion, Gardin notes the following, in his introduction to Allard et al.'s conceptual analysis of the Coran :

> the orientation of research and, consequently, the way in which observations are differentiated are indeed quite different according to whether one deals with chemical reactions, recipes, or philosophy. The mental processes involved are no doubt akin; but the organization of the experimental field, in some way or other, by means of the vocabulary, varies to such an extent that it seems unreasonable to try to reduce it in each case to a single mould (Allard et al. 1963, II 18; my translation from French).

Similar points have been made in the linguistic literature on several occasions. Bolinger has suggested that Katz and Fodor's lexical entries are unable to incorporate various types of information about "universes of discourse", and Katz and associates have not to my knowledge made any proposals to solve the problem. Bolinger, for instance, is doubtful about how Katz and Fodor's semantic representation of lexical items could serve to disambiguate the sentence *He became a bachelor in 1965*, by incorporating the information that "knighthood died out a long time ago" (Bolinger 1965, 561). As he also points out :

> The radical shifts effected by metaphor throw into relief the bold differences between universes of discourse in the totality of language. They raise the question of whether it will ever be possible to attack everything, from slang to technology to science and back again to politics, religion, and the home, with one arsenal of categories. (*ibid*., 567)

Harris has recently made a similar point, from the angle of the distributional linguist, for whom the basic fact to account for is the extent to which some sentences are "acceptable " :

> Many sentences are really to be found only in particular types of discourse, i.e., in the neighbourhood of particular other sentences ; and many of these would indeed be but dubiously acceptable sentences outside of such discourses. Thus *The values approach infinity* is normal in mathematical discourse but rather nonsensical outside it. *It rotates about the bond*, acceptable in chemistry, may be nonsense in ordinary English (...) If *Meteorites flew down all around us* is an acceptable sentence, it is not because this is a meaningful word combination, since *flew* means here not "flew" in the usual sense but some movement distantly similar to it. The datum is simply that *flew* is used here, i. e. occurs in an acceptable sentence with *meteorite*, by virtue of some extension or other process of language use. (Harris 1968, 52).

The solution, then, which does not commit the linguist to philosophical speculations, consists of treating the diversity of metalanguages as a fact by giving "theoretical recognition" in linguistics "to the tacit presuppositions and assumptions in the speech-community" and to take "no account of their validity within some other frame of reference assumed to be absolute or linguistically and culturally neutral" (in a discussion referred to above on synthetic vs. analytic truth and on "pragmatic implication" : Lyons 1968, 445; cp. Fillmore 1967 : "The Grammar of HITTING and BREAKING", studied in their "non-transferred meanings"; and Fillmore 1969b on 'Verbs of Judging').

In contrast with such a position, Katz and Fodor believe that when people are unable to produce or understand "sentences with technical words" which they don't know, such "exceptions" to the fluent speaker's "ability to produce and understand any sentence of his language" are "of no systematic importance" (1964, 481). In the present state of linguistic semantics, I believe this to be a gratuitous claim, involving a philosophical commitment to be rejected as in contradiction with facts (cp. Harris's related one-page programmatic proposal to "conjoin" sublanguage metalanguages with each other by means of metalinguistic conjoined sentences, in Harris 1968, 155). The purpose of what follows, then, is not to present any kind of psychological hypothesis or philosophical speculations, but to introduce facts that will characterize the present study - despite the occasional use of such convenient terms as "concepts", "knowledge of the world", etc., according to a common practice in linguistics and other branches of language studies.

1.1.6. Semantic analysis : its components and formal requirements.

I now wish to outline the metatheoretical conception of semantic analysis which underlies the present thesis, after a recent comparative study by Gardin of "semantic analysis procedures in the sciences of man" (Gardin 1969). In order to do this, it is necessary to refer back to the discussion on types of metalanguages presented in section 1.1.4. In this discussion, I suggested that a consideration of the communicative function of language imposes a distinctiveness requirement on semantic analysis and that such a requirement can be met by selecting the appropriate type or types of metalanguages. I also suggested that to be rightly called a linguistic theory, a metalanguage needs to be describable as a 'public' metalanguage, and I have argued that the documentary languages such as classification systems, which are used by documentalists, meet this description of 'public' metalanguage : both linguistic theories in this sense and classification systems or the like are set up and used by a community and can thus perform a communicative function which is not performed in the same way by what has been called 'private' metalanguages, and illustrated by the semantic markers used by Katz and the definitions underlying them. As I have also pointed out, the difference between a linguistic theory and, say, a classification is that a classification is 'field-specific'. A classification is set up for a group of people or observers to make distinctive semantic statements in a field, while a linguistic theory does not serve this function : no linguistic theory, for example, can serve to make semantic statements that are distinctive and 'public' about English abstracts in the field of documentation, or, more precisely, about the English of documentation abstracts - the object-language under scrutiny in this thesis.

The above distinctions are, I believe, intuitively clear and rest on unquestionable facts - at least as far as the topic of this thesis is concerned : even if the situation is different (and, as I have argued, obscured) in the case of semantic analysis of 'everyday' language, this does not affect the point which I am making, and which could equally be made about a host of other 'fields'. The purpose of this discussion, however, is not to show how clear my distinctions are. On the contrary, these distinctions are intended to introduce the fundamental PROBLEM of this thesis, as I see it after suggestions made in Gardin's discussion of semantic analysis as practised in particular by the content analysts of the Stone group, and by documentalists such as those working around Gardin himself and a few others.

After Gardin 1969, the content analysts, and recent research in TG theory, I shall now make use of the following terminology :

(i) Metalanguage will stand for what can be described as 'field specific', 'public' semantic metalanguages : documentary languages such as classifications, or the content analysts' systems of "characteristics" or "categories" such as those illustrated above with 'conservatism'. The metalanguage used in the present study is a kind of classification set up for the field of scientific information (documentation) by N. Gardin and F. Lévy.(1967).

(ii) Theory or linguistic theory (rather than the term model used by Gardin 1969 and applied to non-linguistic models) will serve to refer generally to theoretical research in linguistics or, more specifically, to the selection made in this thesis of those theoretical points in linguistics that I believe to be directly relevant to my topic.

(iii) Procedure is the term which, after Gardin, I shall apply to attempts made in the fields of content analysis and documentary analysis to express the relations established empirically between a given metalanguage and a given object-language in the form of a system of rules meeting certain requirements of form discussed below, and amenable to mechanization or computerization. As already noted, Part II of this thesis presents such a procedure, which I have set up and computerized at the University of Victoria. This procedure relates the classification system mentioned above in (i) to a few English abstracts in the field of documentation. As far as linguistic theory is concerned, my procedure is an attempt to make specific statements after general rules such as those proposed in Harris's string analysis theory. (Harris 1965).

(iv) *Deep and surface structure*. Unless otherwise specified, I shall use these terms not in the meaning in which Chomsky 1965 and others after him have used them in 'syntactic' theory but rather in the sense in which some of Chomsky's disciples such as Lyons, Fillmore and Langendoen, use these terms to make a broad distinction between the semantic representations of sentences (their deep structures) and the representations of them which are closest to their physical manifestations (hence 'surface' structures), for instance as words on the page as is the case of the written material under investigation in this study. The distinction as used here, however, can be said to originate from a problem raised by Chomsky himself. In a passage which may serve as an illustration of the kind of distinction I shall be concerned with, Chomsky 1965 (162) notes that "there are cases that suggest the need for an even more abstract notion of grammatical function and grammatical relation than any that has been developed so far, in any systematic way". Chomsky notes, for instance, the "meaning relation, approaching a variety of paraphrase" that holds between sentences such as "*I liked the play*", "*the play pleased me*". To these, one could add other equivalent sentences such as *I liked what they performed*, and *What they performed pleased me*. A deep structure representation of such sentences, then, will have to state somehow the equivalence in meaning between them, while their surface structure representation will account for the way they actually appear as written or spoken material. For instance, the surface structure representations of the above sentences will state that *like* requires *I*, and *please* requires *the play* as subjects, and will state the functional similarity between *the play* and *what they performed* as subjects of *please*. Ideally, a linguistic theory such as that currently under investigation by Lyons, Fillmore, Langendoen and others will also relate both types of representation to each other by rule. This, however, cannot be done in the present state of linguistics on the basis of a generally accepted theoretical framework : typically, Leech relates "semantic and grammatical structures only informally" (Leech 1969, vi), and Fillmore has refrained from publishing transformational extensions of his work on semantics ever since 1968. The only thing, then, that seems to be generally accepted within the distinction between deep (semantic) and surface

> (grammatical) structure is that semantic and grammatical descriptions should use different symbolic conventions. As I shall point out later, those proposed for semantics are based on the quasi-logical predicate-argument form, while those used for surface structure descriptions are based on more traditional-looking symbols of grammar such as those made familiar by Harris or by Chomsky (Noun Phrase, Verb Phrase, Noun, Verb, etc.), on the basis of which grammatical functions or relations such as subject-of can (but need not) be defined.

I am now in a position to outline the metatheoretical proposals made in this thesis. After Gardin 1969, I propose to regard metalanguage, procedure, and theory as "the three components of semantic analysis" (Gardin 1969, 34) and to consider the purpose of each particular semantic investigation as that of "clarifying" the nature and interrelations of these components, by meeting certain requirements of form.

The following chart may serve to present my metatheoretical proposals and the general organization of this thesis :

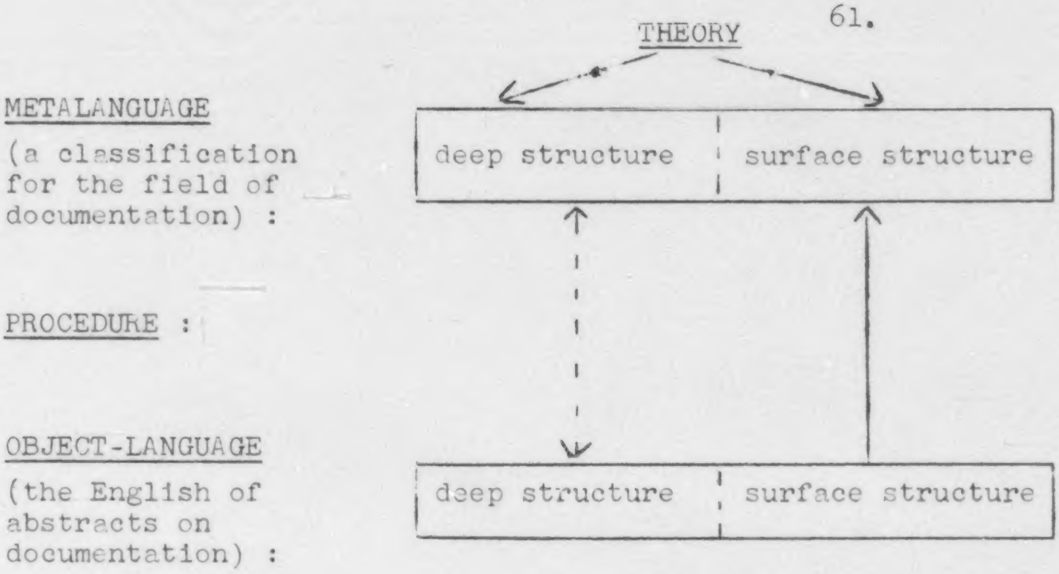
THEORY
METALANGUAGE
(a classification for the field of documentation) :
deep structure
surface structure
PROCEDURE :
OBJECT-LANGUAGE
(the English of abstracts on documentation) :
deep structure
surface structure

Figure 1 · the components of semantic analysis.

The dotted lines and arrows indicate what I believe should ideally be done but can only be tentatively investigated in the present state of language studies, while the continuous lines represent what has actually been accomplished, and computerized in Part II of this thesis. In the computerized procedure which I present, each of a set of fifty English abstracts in the field of documentation has been reduced mechanically to one or more entries of a classification for this field. As symbolized in Figure 1, the rules used by the computer treat the abstracts analyzed as a succession of sentences, and these rules specify the surface structures of these sentences. The classification entries into which the abstracts are eventually reduced are equally treated as surface structures of the general form "X which is defined as...", corresponding to the fact that the classification system used consists of 'words' ~~with~~ with definitions.

As noted earlier, Harris's *string analysis* theory provides the main basis for the surface structure analyses presented in this thesis.

Part III of this thesis is devoted to deep structure considerations, i.e. to problems of semantic representation. I argue that these are relevant to both the object-language (that of the abstracts under investigation) and to the classification entries used as a metalanguage. About these entries in particular, I shall assume that, since they have the form of 'words' with definitions in a natural language, the theoretical distinction between deep and surface structure needs to apply to them, as it does to the object-language data. On the other hand, their metalinguistic status also needs to be given theoretical recognition. To take an extreme example, such a recognition will enable us to ignore the relation, which a "detached linguist-observer" might like to investigate, between the meaning of *retriever* as 'dog' and the meaning of the same symbol in an abstract of the Janaske corpus : "the individual as a user, generator, and *retriever* of information" (Janaske 282). The two-directional arrow written in dotted lines in the above chart symbolizes my assumption that an ideal procedure for documentation purposes would relate two kinds of deep structures (one for a metalanguage such as a classification and the other for, say, abstracts in a particular field) and that it would do this both ways, i. e. that it would be *reversible*. This means that ideally a computer system for semantic analysis could both analyse the texts of the object-language into their deep structure representations and these in turn into deep structure representations of the metalanguage, *and* similarly synthesize surface structures of abstracts using surface and deep structures of the metalanguage as input. As Gardin 1969 has argued, a reversible procedure could be used as a means of experimental verification, by appealing to the judgments of competent informants (Gardin 1969, chapter 5).

The role proposed for the *procedure* in this study is ideally to make the empirically established correspondences between object-language and metalanguage "explicit" or "formal" by accounting for them in terms of operations stated in the form of rules. As already noted, the part played by the theory in setting up these rules is a matter of investigation. As Gardin puts it, an ideal procedure

> "must be precise and complete : precise, in the sense that the analytic operations must be explicitly defined, and complete to the extent that these analytic operations must adequately account" for the passage from object-language to metalanguage, and vice-versa. (Gardin 1969, 18).

The requirement of explicitness has already been defined above after Stone *et al.* (1966, 11) : an explicit procedure is one that can be "replicated exactly by other analysts". The *symbolic* aspect of this explicitness requirement is an aspect which is directly relevant to the role of the computer. It can be described in terms of Katz and Fodor's ideal of a "formal" statement as one "in which the application of rules is defined solely in terms of the shapes of the symbols they apply to, and the operations which the rules effect in producing their output are mechanical", i.e. do not rely on "the speaker's intuitions or insights" (Katz and Fodor 1963, 192).

While I shall have to return to Chomsky's distinction between competence (broadly theoretically defined "knowledge of the language") and performance (roughly, actual use made of this knowledge), I must note at this point that the *procedural* conception of semantic analysis outlined here is presumably in opposition with views expressed by Chomsky and some of his associates (e. g. Katz and Postal 1964, 166).
I shall assume that Chomsky uses the term procedure in much the same sense as I have done here, in spite of a passage where he defines a "reasonable procedure" as "one that does not involve extralinguistic information - that is, one that

does not incorporate an "encyclopedia"" (Chomsky 1965, 201-2, ftn. 17). For Chomsky, then :

> the grammar does not, in itself, provide any sensible procedure for finding the deep structure of a given sentence, or for producing a given sentence, just as it provides no sensible procedure for finding a paraphrase to a given sentence. It merely defines these tasks in a precise way. A performance model must certainly incorporate a grammar ; it is not to be confused with a grammar. (*ibid*., 141).

If Chomsky's distinction between a "procedure" and a "precise" definition of the tasks involved in one is intended to emphasize the 'state of our ignorance' I can only agree. If, however, it is to be read, after Leech, as the expression of a "rather novel philosophy of science" according to which "the primary purpose of science is not to explain and predict observable happenings, but to "gain insight" (Chomsky 1965, 20)" (Leech 1968, 90) I can only disagree.

1.2. METALANGUAGE

1.2.1. *Compatibility between metalanguage and object-language.*

This section deals with my selection of the object-language and of the metalanguage for this study. As will be remembered, I wish to take for granted the general suggestion made by Leech to regard the semanticist's task as that of explaining what underlies statements such as *x means y*. I shall touch upon some aspects of Leech's suggestion below, under the headings 'Theory' (1.3.) and 'Procedure' (1.4.). Here, I wish to return to Leech's suggestion in one of its aspects which is relevant to a central fact about the present investigation. After Leech the purpose of this study can be described as that of accounting for what "underlies" (in a sense to be explained later) *semantic judgments* which are statable as an extremely complex *sentence* of the type "*I* (the linguist-observer acting as an expert-indexer) *relate x to y*." In this sentence, *x* is an abstract belonging to the object-language, and *y* consists of one or more entries of the classification chosen as a metalanguage. The object-language is the English of abstracts on documentation, and I draw these abstracts from a specialized bibliography compiled by an American team and edited by P. C. Janaske (Janaske 1962). The classification used as a metalanguage has been set up by N. Gardin and F. Lévy (1967). As will appear from the following example, the sentences by means of which my semantic judgments can be expressed are extremely complex, as *x* is a whole text (an abstract) which is posited to be reducible to a sentence (see 1.3.2.) and *y*, one classification entry (or more), consists of a noun phrase with a definition : the original version of the classification is in French and my quotations from it will be given in my own English translation. Consider, for instance, my semantic judgment about abstract 1 of the Janaske bibliography :

I relate

(the abstract)

The Japan Information Center of
Science and Technology and its
activities.

A general description of the Japan Information Center of Science and Technology which was established for the purpose of contributing to the development of science and technology by collecting, processing, storing, and retrieving scientific information. At the time of this report, the Center was planning to change over to a mechanized storage and retrieval system to that used by the U.S. Patent Office. Services available from the Center and the charges for each are listed.

Similar ✓

to

(the classification entry)

Scientific and technical information institution which is defined as :

institutions more or less directly concerned with scientific and technical information (archives, indexing services, translation centres, etc) when studied individually - structure, functioning, cost, budget, etc. - or by types : role, models, evolution, in particular with respect to mechanization.

Figure 2 : Example of a semantic statement.

The problem I wish to raise here is on what basis it can be assumed that the abstracts of the Janaske bibliography and the Gardin classification are compatible, or relevant to each other. In other words, I wish to raise with respect to this study the question referred to above as that of observational appropriateness conditions, and illustrated with the case of book titles ("Advanced microbiology" versus "* Advanced microbiology for the elementary school"). This question is best answered by again resorting to Leech's suggestion. The title of the Gardin classification (which includes 25 main entries such as that quoted above) explicitly mentions that the classification is "in the field of scientific and technical information". Besides, the Janaske bibliography is entitled "Information handling and science information. A selected bibliography 1957-1961". My assumption, then, concerning the compatibility between the two can be stated in the form of the following judgment, which relies on the experts' judgments just quoted and posits a semantic equation between the two :

I assume that

the Gardin classification

which is said to be "in the field of scientific and technical information"

(more conveniently referred to as "documentation")

and

which consists of the following 25 main entries : "..."

is relatable to

the Janaske bibliography

which is entitled "Information handling and science information"

as explained in the following preface (...)

and

which consists of the following abstracts : (in total 1121)

Figure 3 : Statement of the assumed compatibility between the object-language and the metalanguage.

This is an obviously huge and complex sentence, which needs to be somehow reduced to more researchable proportions. I have given it here, however, for several reasons. First of all, it embodies a *fact* the complexity of which comes close to what TG linguists have been able to imagine on the basis of their highly abstract conception of the sentence : sentences too long to be processes in one's lifetime, etc . Secondly, the situation which it symbolizes is even more complex than might at first appear if one considers it in the light of Chomsky's notion of competence, or rather a version of it which I attempt to define below (1.4. 1.). In brief, the problem is not so much that people actually "perform" the action of uttering an "appropriate" judgment involving 25 classification entries and 1121 abstracts. The problem lies rather in defining their "competence" or ability to utter such statements or judgments, including some that can involve far *more* than the 1121 abstracts compiled by Janaske. Concretely speaking, it is the problem of why an expert in documentation working in a library or documentation centre can use the Gardin classification (or another : see 1.2.2., below) to represent the meanings of *any* abstract or text in his field, while he has never come across them before. Thirdly,and perhaps most importantly as far as my proposed *theoretical* conceptions are concerned, Figure 3 and the passage from the Janaske preface quoted presently point to a puzzling paradox related to that of field-specific metalanguages mentioned above : it seems to be easier for people to utter semantic judgments involving a huge and complex mass of data than to utter *specific* judgments concerning *parts* of these data. This appears most clearly from the fact that the compilers of the Janaske bibliography were unable to index each individual abstract of their bibliography (they merely list the abstracts alphabetically by author) while they seem to be perfectly confident in their pertinence judgment concerning the bibliography *as a whole*.

The following passage from the preface to the Janaske bibliography provides evidence for what precedes. Besides, it points to various intricacies of the field of "scientific and technical information" upon which I shall not comment, and to the crucial fact that the Janaske corpus represents only an inconsiderable portion of the inderteminate number of abstracts and texts "on the subject of information handling and science information" :

> Conducting investigations and doing research problems in the area of science information requires literature support just as any other research. The sources of information and the organization are somewhat more complex and difficult to manage. The "field" is new, and a communication problem is present in every field of interest. There is no single source one can consult to locate and identify reports ranging in scope from data handling to information storage and retrieval; or from classification schemes to the administration of a document collection. Reports of work falling within the scope of interest may be found in trade and industrial reports, government reports, and a wide variety of serials ranging from trade and commercial to specialized journals. It is interesting to note that nearly every indexing service includes the terms "automation," "communication," and "documentation," but only a small percentage of the entries are pertinent to the subject of information handling. Collecting reprints or even bibliographical references relating to information in this field of interest very soon produces a large volume of paper. It is unrealistic to confine one's efforts related to information handling to a single subject discipline - the basic principles or routines which may be applied to the chemists may be equally useful and adopted for use by the biologists. The subject of "information handling and science information" as used here covers the full range of science. The arrangement of the bibliographic entries is alphabetical by author. (...) Each item has been numbered for indexing purposes. The major emphasis in making the selection of items to be included in this bibliography is handling of scientific information and the application of mechanical systems of information storage and retrieval. In addition to this, related areas of interest such as scientists' use of literature, guides to the use of scientific literature, mechanical translation, training of information specialists, reprography, subject classification, and indexing have been included. In order to limit the size of this bibliography to a manageable proportion, the past five years (January, 1957, to December, 1961) is the period represented by the items in this bibliography. A few items which have appeared early in 1962 have been included because of their significance.

One last and even more difficult point needs to be mentioned here. One may wonder why I have selected a bibliography of abstracts, rather than integral texts, for the present investigation. The tentative answer is this. Beyond the intuitively obvious point that abstracts will be less complex than the corresponding integral texts, it must be assumed that the available classifications in the field of "documentation" are - in some obscure way - less compatible with integral texts than with abstracts, in that they do not define a "culture" rich enough to deal with integral texts. Intuitively, this even seems to be the case for some abstracts of the Janaske bibliography, as the following example suggests :

> 551 KREMENEKAJA, A.V., and LEV, D.I.
> New methods for presenting bibliographical information in the U.S.S.R.
>
> Two methods of disseminating scientific and technical articles are described as used by the State Public Scientific and Technical Library attached to the Siberian Department of the USSR Academy of Sciences. The first method, which is suitable only for individually prepared bibliographies or other cases requiring only a few copies, involves the use of pockets the size and shape of catalog cards into which microfilm copies of articles are inserted. The bibliographic description, classification number and card number are printed on one side of the pocket, and the serial and classification numbers are shown on the first frame of microfilm. Production costs are about two rubles a card. For current information on a large scale, microcards are used. Since the average article is only four pages in length, a modified type of card is prepared which reduces the original only five or six times. The cards can, therefore, be read with very simple magnifying glasses. Bibliographic information is photomechanically printed on a catalog card, on the back of which is pasted the photographic reproduction of the original. At the beginning of 1960 the Library opened a subscription list and inaugurated a pilot service of this kind for mechanical engineering and plastics.

1.2.2. The notion of "concordance".

As Botha has noted, it is a fact that there exist in linguistics, like in other disciplines, several competing theories, and the relations between them or between their constituent concepts are far from clear or straightforward. In this section, I wish to point out that the same is true of metalanguages (documentary languages) for a single field, that this is a fact which needs to be given recognition, and that documentalists (and to my knowledge, nobody else) have solutions to propose with respect to this fact. First of all, I wish to concur with Gardin's view that "the diversity of documentary languages" is :

> the reflection of the necessary multiplicity of points of view on the empirical world, not so much for the ideological reasons which instinctively come to mind (freedom of thought, etc.) as for scientific reasons which are much more serious. These stem from the fact that one has to develop different symbolic quantifications in regard to experimental phenomena of the same order, so as to build up complementary theories about them (...) That all these theories may ultimately be reconciled - there is nothing to prevent one from thinking or believing so and hence to speculate on an ideal symbolization compatible with each specific scientific language (pertaining to a special field) - but one must always bear in mind the paradoxical characteristic of the temporal success of any such project : it would imply that scientific research has come to an end, having reached its ultimate goal. (Gardin 1969, 22-23).

Such a position has, I suggest, received metatheoretical recognition in various forms from some students of language, but has been given astonishingly little theoretical attention. Thus, in a discussion on implication, Lyons stresses that understanding is relative to the observer or addressee :

> What is normally meant by 'understanding' utterances can be quite well accounted for without making the assumption that all speakers of a language will draw from an utterance exactly the same set of implications. (Lyons 1968, 446).

Lyons's position can be compared with Harris's proposal to analyse sentences in terms of reconstructed 'metalinguistic" conjoined sentences, and with his insistence that these reconstructions "will vary for different audiences" (e.g. They described Vesuvius AND VESUVIUS IS A VOLCANO rather than a mountain : Harris 1968 :166). This, it should be noted, is different from the conception of Katz and Fodor that "any sentence may be made to mean anything you like simply by constructing the setting to include the appropriate stipulation" (Katz and Fodor 1964, 488) : here, the only communication situation envisaged is (at best) that in which the linguist-observer acts as sole addressee, and only his personal intuition is confronted with the full complexity of the conceptual indeterminacy of linguistic utterances in the whole of a language.

In order to face the practical problems resulting from the existence of several documentary languages in a single field or discipline, documentalists or information scientists have developed "compatibility" or "convertibility" studies (Henderson et al., 1966, in Gardin 1969). I shall not attempt to discuss these studies here. What matters for the present purpose is that they can lead to the setting up of what may be called, after N. Gardin and F. Lévy, "concordances" between several classification systems in the same field ; other names for such conversion systems between classifications and the like are "intermediary lexicon" or "basic lexicon" (Gardin 1969, 23). Gardin and Lévy's metalanguage for the field of documentation is such a system. A description of it can be found in N. Gardin 1969. In brief, it has been set up to ensure convertibility between essentially 6 classifications from several countries and institutions. Moreover, I must stress the fact that the concordance results from a close cooperation (meetings, discussions, etc.) between N. Gardin and F. Lévy on the one hand, and the authors of the classification systems involved, on the other. This fact points to the public character of the Gardin concordance, in the sense of my discussion on types of metalanguages (1.1.4.).

In spite of the fact that such concordances "are not intended to replace existing information retrieval languages" (i.e. documentary languages : Gardin ibid.), I have decided to make use of the Gardin-Lévy concordance as a metalanguge for this study because it enabled me to achieve an important preliminary simplification of my research problem. As the concordance is organized around 25 main headings with definitions, I decided to use these 25 headings as a metalanguage, thus reducing the problems raised by my mechanized indexing experiment (Part II) to a study of the relations between a limited number of abstracts and the 25 headings in question. The headings (called "groupes") together with their French definition are quoted in Appendix 1. My English translation of the headings is given in Appendix 2.

1.3. THEORY

1.3.1. 'Sentence' deep and surface structure : an evolution.

This introductory section is intended to outline a fairly recent evolution (if not a revolution) which has taken place in TG theory, the linguistic theory initiated by Chomsky mainly after Harris's proposals on "transformations". Here I am less concerned with this evolution as such than with some of its developments because these form the basis of the theoretical framework I wish to propose in this study. My discussion will proceed in four main stages. First, I shall briefly illustrate the theory proposed by Chomsky and his associates, around their distinction between deep and surface structure and around the conception of the semantic component of this theory as proposed by Katz and his associates, and the parallel metatheoretical indeterminacy (the indeterminate boundaries separating the domains of syntax, semantics, and "systems of knowledge and belief" in Chomsky 1965). Secondly, I shall consider recent alternative proposals, which are at least partly intended to put an end to this indeterminacy. Thirdly, I wish to point out why, in my opinion, Fillmore and a few others go a step further in the same direction. Fourthly, I shall examine the evolution of the notions of "sentence" and "sentence context" within the general metatheoretical and theoretical evolution under discussion. From the outset, I must point out that this discussion reflects my *own* interpretation of the developments of TG theory in the last five years or so, as a history of these developments has not to my knowledge been written so far (on this topic see my recent paper : J. Noël 1971).

Using the terms "deep" and "surface structure" apparently first introduced into linguistics by Hockett, Chomsky has based his theory of syntax on the "central idea" that

> the syntatic component of a grammar must specify, for each sentence, a deep structure that determines its semantic interpretation and a surface structure that determines its phonetic representation,

that the deep structure and the surface structure of a sentence "are, in general, distinct" and that "the surface structure is determined by repeated application of certain formal operations called "grammatical transformations"" (Chomsky 1965, 16) to deep structure representations. As Botha most succinctly illustrates it :

> To take an example from Chomsky (1964a, p. 34), in the representations of the surface structures of the sentences
> (7) (i) John is easy to please
> (ii) John is eager to please
> it is not specified that while John is in 7 (i) the direct object of please, it is in 7 (ii) the logical subject of please. Secondly, in the case of syntactically ambiguous sentences, more than one deep structure must be taken as underlying one surface structure. For example, to account for the ambiguity of
> (8) what disturbed John was being disregarded by everyone
> two deep structures must be taken as underlying this one surface structure. (Botha 1968, 25-26)

Surface structure, then, is the grammatical representation of sentences that is closest to their spoken or written form, while the deep structure representation(s) is (are) 'abstract', i.e. removed from the surface structure, to a degree to be determined by the theory. The two main assumptions of the theory are that deep and surface structure "are, in general, distinct" and that deep structure representation is primary in accounting for people's ability to express "indefinitely many thoughts" and to react "appropriately in an indefinite range of new situations" by means of the sentences they produce and understand (Chomsky 1965, 5 : this, as will be noted again later, is a fundamental point in the TG conception of language).

As already noted, Katz and his associates developed a semantic theory to serve as the semantic component of Chomsky's general theory, and this component was to operate on the deep structure representations of sentences. For this reason, it has been called "interpretative", in the sense that it interprets semantically the (deep structure) output of the syntactic component of the theory.

For Chomsky 1965, however, as well as for Katz and his associates, the boundaries separating syntax and semantics are indeterminate, that is, the question of determining the respective domains of the syntactic and semantic components of the theory is a matter of investigation. This appears most conspicuously in Katz and Fodor's famous negative delimitation of semantics : "synchronic linguistic description minus grammar equals semantics" (1963, 172).

In the mid-sixties, an evolution in TG linguistics took place which can be described in terms of the assumption "that there is no real distinction between syntax and semantics" and "that the rules for combining material into sentences are really rules for combining semantic material". (McCawley 1968, 586). The obvious consequence of such a conception is that the existence of syntax and semantics as distinct components of the theory may be unnecessary. This is particularly clear in Fillmore's comments on his motivation for setting up his theory of semantic deep structure relations ("case" relations) :

> If it is possible to discover a semantically justified universal syntactic theory along the lines I have been suggesting, if it is possible by rules (...) to make these 'semantic deep structures' into surface forms of sentences, then it is likely that the syntactic deep structure of the type that has been made familiar from the work of Chomsky and his students [will appear as...] an artificial intermediate level between the empirically discoverable 'semantic deep structure' and the observationally accessible surface structure, a level the properties of which have more to do with the methodological commitments of grammarians than with the nature of human languages (Fillmore 1968a, 88).

While the conception as formulated by Mc Cawley makes it possible to quibble by saying that, after all, one's concern with "syntax" has always been a concern with semantics, the reality of the evolution appears unequivocally in the above quotation from Fillmore and in other recent studies - in the topics they deal with and in the kind of problems they raise and arguments they use. A paper by Lakoff (1968b) is another good example of a radical departure from the TG as well as other traditions. In this paper, Lakoff advances a number of arguments for considering that sentences of the types *x did something with y* and *x used y to do something* have the same or a similar deep structure. While he does not say what this deep structure would be like, the suggestion is that it is needed in the theory in order to avoid having to state again and again the same rule for a number of constructions in which the two types of sentences clearly have the same 'semantic' and 'syntactic' properties (e.g. "*x* must be animate").

I now wish to argue that such researchers as Fillmore have carried the evolution under discussion even a step further. In a paper written as early as 1965, Fillmore was concerned with what he then called "entailment rules". Typically, he explicitly presents these rules as rules of semantic interpretation which lie *outside* the scope of the semantic interpretative component of the theory set up by Katz and associates:

> entailment rules can be described, roughly, as operating in the following way : There is a sentence X which cannot by itself be interpreted by the ordinary semantic rules. Based on the grammatical structure of X, the entailment rules will convert X into a set of sentences Y such that each of *these* sentences *can* be interpreted by the ordinary semantic rules. The semantic interpretation of the set of sentences Y, then, is provided as the semantic interpretation of the sentence X. (...) Consider the difference between the sentences "She reads Sanskrit" and "She even reads Sanskrit". The second tells us the same as the first, but it adds that this fact is somehow surprising. The contribution of the word "even" cannot

> be explained, it seems to me, by assigning it semantic features of the usual kind. I would say that the sentence "She even reads Sanskrit" is to be 'factored', so to speak , into two sentences, namely "She reads Sanskrit" and "One would expect that she does not read Sanskrit". (Fillmore 1965, 65-6 and 68).

The present outcome of the evolution in some current TG research has been noted above, in connection with several studies : Fillmore's "Grammar of HITTING and BREAKING", his presuppositional studies such as that on "Verbs of Judging" (Fillmore 1969), Green's analysis of sentences with such words as "*too*" and "*not ... either*" (Green 1968), R. Lakoff's study of conjunction (1970). In all these studies, grammatical surface structure has become the interpretative level of representation. More importantly, what this level interprets is a type of semantic representation of which is required that it should be *specific* or *distinctive* about '*concepts*' : as appears from Fillmore's recent research, the conceptual interrelatedness of lexical items and their *conceptual* contribution to sentence meaning have become central preoccupations in the (primary) semantic level of representation. Since my concerns here are metatheoretical, I can ignore the problem of whether Harris's contributions are "in" or "around" TG theory, and point out that Harris 1968 provides clear evidence that this author is going much the same way as Fillmore and others, with respect to the requirement for linguistic description to be conceptually specific. While I need not be concerned with the problem here, it is interesting to note that, like Green, Harris even goes a step further than Fillmore, by giving the same theoretical treatment to *idiosyncratic* conceptual facts as to those that can be regarded as part of "the language" or of a "sublanguage". In the same way, Green discusses types of "not ... either" sentences that may be said to reflect the conception of the world of some mentally disturbed person.

Harris, then, argues that any metalinguistic "CS" (conjoined sentence) having the "property of being known statements of the dictionary or grammar, or of being common knowledge" (i.e. specific knowledge shared by addressor and addressee) can be zeroed and, conversely, reconstructed : thus, "The war will start unless he enters the room" is only fully acceptable if the communication partners are able to reconstruct it as, say, "Since the invaders threaten war unless the Prince of Cambodia comes to their conference room, the war will start unless he enters the room" (Harris 1968, 132-4).

I would argue, then, that all this points to the emergence of one or more linguistic theories aptly described as "syntactico-lexicologico-semantics" (Elliott _et al_. 1969, vi), in the sense that they are designed to be specific about conceptual facts _and_ that they do this by means of an 'integrated' conception of language structure. In this conception, 'dictionary' and 'grammar' are no longer treated in isolation, but _both_ at the same time. Such a conception has actually been stated recently by Fillmore and Lehiste, in the form of some basic assumptions underlying their research project. They describe their problem as :

> that of determining the nature of lexical information in a generative grammar of English. The ultimate, though probably unachievable, goal of such efforts is the design of a dictionary which will make available to philosophers, foreigners, and computers, everything they need to know about the meanings, uses and forms of the lexical items in our language, and which will provide this information in a usable format. In a very real sense, all research in generative linguistics is relevant to questions of lexicology. Decisions on the form and explanatory scope of the theory of grammar determine in very direct ways the difference between the general or 'grammatical' facts about a language and the more specific or 'lexical' facts about its individual words. The rules for determining the well-formedness of the abstract underlying structure of sentences are rules which in the end specify acceptable combinations of grammatically organized lexical items. (Fillmore and Lehiste 1968, v).

A further aspect of the evolution discussed here will be examined below under the heading 'Structural semantics', in connection with an adaptation of some logical theories to semantic deep structure representation. All of these proposed adaptations cannot be compared and evaluated in the present study ; only some of them will be discussed in Part III of this thesis. What I wish to point out here is that these recent developments add a new assumption to Chomsky's conception of deep structure as, in general, distinct from surface structure and as the primary level of representation. The new postulate is that the symbolic conventions used in semantic deep structure representation are different from the grammatical symbols of surface structure representation. I shall accept this assumption in the present study. I must note, in this connection, that a similar assumption has been made by information scientists before it was made in linguistics, in particularly by Gardin and co-workers : as early as 1964 (Cros et al. ; cp. Allard et al., 1963), Gardin proposed and tested a form of semantic representation based on logical theories in a model (SYNTOL) for automatic storage and retrieval of scientific information. This concurrence between documentalists and linguists provides additional justification for the attempt made in this thesis to bring the two fields closer to each other.

My fourth point concerns a shift in the conceptions of the "sentence" and of "sentence context" within the evolution under discussion. The first thing to be noted is that much of the originality and interest (as far as this thesis is concerned) of TG theory, including Chomsky's, lies in the highly abstract conception of the sentence at the level of "deep structure". Chomsky has opened up the theoretical possibility of considering indefinitely long or complex sentences : for instance, sentences too long for them to be spoken or heard in one's lifetime. Thus, in a syntactic deep structure ("base") rule such as that given in Langacker's handbook (1967, 109), the symbol S (=sentence) is rewritten as a conjunction of indefinitely many S's. To me, such a rule suggests that, even in the theory of syntactic deep structure inherited from Chomsky, the existence of a clear notion of "sentence context" is far from obvious. The same uncertainty concerning this notion in a semantic conception of deep structure appears in Robin Lakoff's recent study already referred to on the semantics of conjunction (R. Lakoff 1970). In this study, it appears that Robin Lakoff has ceased to distinguish sharply between a "sentence" and a "discourse". I shall discuss this point in more details in Part III, since R. Lakoff's paper is one of the main sources upon which the semantic part of this thesis is based. In connection with the difficulty of distinguishing between "sentence" and "sentence context", let us also note the famous hypothesis of Katz and Fodor, which is formulated in a passage quoted in the following section.

1.3.2. Surface structure of 'sentences' and beyond.

The conception of surface structure proposed in this thesis is an adaptation of Harris's string analysis theory (Harris 1965), more precisely of an extension of it by Sager and co-workers (Salkof and Sager 1967). This extension can be outlined around the notion of "restrictionless" string grammar. The nature of my adaptations is determined in part by computational requirements, but especially by the role of a metalanguage in the metatheory proposed for this study, as will be briefly shown presently. The chief claim which Harris formalizes in his string theory can be described as follows. Assuming that the contiguous "morphemes" or words forming acceptable discourses can be represented as acceptable sentences, these can be regarded as contiguous strings consisting of contiguous "grammatical" classes (parts-of-speech categories) and subclasses, and these strings of contiguous classes and subclasses can be represented by lists of axiomatic string formulas. These formulas, then, state what sequences and dependencies of classes and subclasses are combined into acceptable sentences of a language or sublanguage. An "acceptable" sentence is said to "satisfy" the formulas in question. Harris's basic postulate for defining string formulas can be described in Salkof and Sager's terms :

> Each sentence of the language consists of one elementary sentence (its center string) plus zero or more elementary adjunct strings which are adjoined either to the right or left or in place of particular elements of other elementary strings in the sentence. [Thus,] there is no problem with discontinuous elements in a string grammar : all elements which depend in some way on each other grammatically appear in the same string or in strings which are contiguous by adjunction. (Salkof and Sager 1967, 1 and 12).

> Roughly speaking, a center string is the skeleton of a sentence and the adjuncts are modifiers. An example of a left adjunct of *N* is the adjective *green* in *the green blackboard*. A right adjunct of *N* is the clause *whom we met* in *the man whom we met*. A replacement string of *N* is, for instance, *what he said* in the sentence *what he said was interesting*. The same sentence with a noun instead of a noun-replacement string might be *The lecture was interesting*. Examples of sentence adjuncts are : *in general, at this time, since he left*. The C-strings (...) have coordinating conjunctions at their head. An example is *but left* in *He was here but left*. Examples of center strings are *He understood* and also *We wondered whether he understood*. (Sager 1967, 158).

The limitations which a given language imposes on sequences of the main *classes* or parts-of-speech categories can apparently be stated by means of a fairly limited number of axiomatic formulas : the first published version of a string grammar of English, in which Harris was mainly concerned with such general classes, contained no more than eleven pages of formulas (Harris 1965, 29-40). In writing a more refined grammar, however, one is faced with the problem of expressing limitations on the sequences of *subclasses* :

> For example, in the sequence *QN1PN2* (*Q* a number ; *P*, preposition), e.g. *five feet in length*, *N1* and *N2* are of particular subclasses: x*five feet in beauty*. (Salkof and Sager 1967, 1).

Salkof and Sager apply the term 'restrictions' to the limitations to be stated on sequences or dependencies of general classes, and the term 'restrictionless string grammar' to a string grammar in which dependencies of *subclasses* are stated by increasing the number of categories and of string formulas : e.g. *N1*, etc., instead of *N*, and, instead of *AN* for all Adjective Noun strings, *A1*, *N1*, etc. One most obvious use of distinguishing subclasses is to predict ambiguities, and to assign the correct structure(s) to sentences. For instance, they will serve to establish the difference between the PN strings *with interest* (analyzed as a sentence adjunct in *he opened the box with interest*) and *with a blue cover*, a possible adjunct of *the box* for the same center string. More fundamentally, a restrictionless string grammar can provide for a given sublanguage a surface grammar that meets the *distinctiveness* requirements discussed above, and it can do this without obscuring or "masking" the relationships between the strings, unlike what Sager seems to suggest (Sager 1967, 162) ; on the contrary, the subclasses and the strings in which they occur are much more explicitly related to each other in such a string grammar than in a more 'general' one such as Harris's first version. In fact, a recent report on unpublished current research by Sager and co-workers of the New York University String Project confirms the general conception put forward in Harris 1968 and exemplified below in a passage on biochemical sentences (Harris 1968, 153) that the grammar of a given sublanguage "intersects" the grammar of the whole of the language but is to be regarded as having distinctive properties, i.e. properties not shared by other subgrammars, or by the grammar of the language as a whole :

> Recently it has been shown that the language of a natural science uses a grammar peculiar to itself. This particular grammar is not a subgrammar of the main grammar. It brings out word classes and sentence relations that are peculiar to the science which the articles treat. It can be used for a critique of the formulations made in scientific formulations of the concepts and relations of that science. (...) The N. Y. U. String Groups is about to begin work on a science sublanguage grammar within the field of pharmacology (*ACM-SIGLASH Newsletter*, 2, 5, December 1969).

As this recent report suggests, the writing and computerization of a sublanguage string grammar by Sager and co-workers (and, as far as I know by any other of Harris's disciples) is still a matter of on-going research, as is the case for the establishment of criteria for setting up the subclasses and the string formulas combining them in such a grammar. I cannot help returning here to my basic point : one wonders how Sager's team, which I presume consists of linguists and computer scientists, will establish on the basis of a linguistic theory what concepts are needed by experts in the field of pharmacology. Other extensions of Harris's original string grammar are even more problematic, whether this be after Harris's transformational proposals (as Sager seems to contemplate : Coyaud 1967, 27) or after both Harris's and Chomsky's transformations (Shapiro 1967), or along other lines.

In the present study, I had to face both problems - that of writing a sublanguage string grammar and deciding on criteria for doing so, and that of finding approaches to an extension of such a grammar - together with the additional problem of discourse or text analysis. In order to outline the approach which this study embodies for setting up a variety of a sublanguage string grammar, and for dealing with relevant problems of discourse structure, I wish to explain briefly how and why I have adapted Harris's original proposals on string grammar.

For one thing, the grammar presented below is of the "restrictionless" variety. It operates on subclasses rather than on general classes. What is retained from Harris's string theory is the general assumption about the possibility of representing the acceptable sentences of a language or sublanguage as strings of contiguous categories by means of lists of string formulas of the type illustrated above. As will be noted, this conception has obvious advantages in computational analysis.

Secondly, the word subclasses, and consequently the string formulas which serve to represent sentence parts and sentences as a whole in the system described in Part II of this thesis have been established on the basis of the conceptual criteria yielded by the classification system used as a metalanguage. As a result, the string grammar presented in this thesis is more akin to Harris's latest proposals (Harris 1968, which was not available to me at the time) than to his proposals in the first version of string analysis (Harris 1965). What I propose, then, is a type of representation similar to that illustrated in a passage of Harris 1968 (152-153), in which he proposes to represent a sentence *The proteins were treated with acid* as $\underline{N_{mol}}\ \underline{is}\ \underline{V_{sol}}\ \underline{en}\ \underline{in}\ \underline{N_{sol}}$. The difference, however, is that in the present study the subclasses are set up on the basis of the fact that a given sentence, or rather the abstract in which it occurs, is relatable to a classification entry - whereas Harris does not say how he establishes subscripts such as those used in the above example.

The major shortcoming of my attempt is the following : while my establishment of the subclasses is determined by the metalanguage, I have been unable to be explicit about how the metalanguage determines the nature of the subclasses I set up. These, in other words, are unfortunately open to the criticism I have addressed in 1.1.4. to Katz's semantic markers : my lexical subclasses belong to a 'private' metalanguage of mine. The only way out of this difficulty is, I believe, to be found in the deep structure considerations presented in Part III of this thesis and directed towards the establishment of the kind of "syntactico-lexicologico-semantic" theory now under development by Fillmore and others.

In addition, because of the central role played by the conceptual metalanguage, the string grammar presented in this thesis abandons Harris's conception of "center strings" as the core or central part of sentence representations, together with the underlying, rather unclear, concept of "sentencehood". As Coyaud has noted (Coyaud 1967, 38), there are many examples of center strings that are not central as far as semantic content is concerned, and, in this thesis, I assume that this fact can only be explained in semantic deep structure. In such cases, it seems that the basic distinction posited in string analysis between the center string (and its constituents) and what is adjoined to it or to the constituents (adjuncts of N, of V, etc.) is semantically irrelevant. In fact, the adjunction relation even seems to obscure semantically relevant relations in the sentence : a semantic *unit* will often consist of *both* the adjuncts *and* what they are adjoined to. Consider the following sentence from one of the abstracts under scrutiny in this thesis : *The system described employs three established techniques : micro-filming, punched-cards, and xerography* (Janaske 1962, abstract 35). If, after Harris (1965, respectively 23, 29, 30), the center string is defined as what remains when "no further excisions are possible preserving sentencehood" and the possibility is allowed of subject and object Nouns occurring in the center string with such categories as article, the center string obtained for the above sentence will be *The system employs three techniques*, and all the other words will be analyzed as adjuncts. This center string is undoubtedly an 'acceptable' sentence. But what is distinctive about the meaning of the original sentence is lost with the excision of the adjuncts, and it seems that this distinctive meaning can only be captured by considering adjuncts and center string *together*. In fairness to Harris, I must point out that in Harris 1968 a far more interesting conception of acceptability is presented than the 'black-and-white' one which underlies the original version of string analysis. In Harris 1968, acceptability is a matter of *degree*, and this conception is central to the whole book, in particular to Harris's transformational apparatus. Such a conception, however, is nothing but a proposal parallel to the conceptions of *deep structure* advanced by and after Chomsky, and in this respect, I feel that Harris 1968 has no proposals that would be equivalent to those discussed below under the heading 'Structural semantics', in the sense that - however elaborate it may be - his apparatus of transformations does not capture, or expresses indiscriminately, notions discussed in Part III such as "presupposition", "case", and "implication". His proposal about the reconstruction of metalinguistic conjoined sentences (CS ; remember the "Prince of Cambodia" example : Harris 1968, 133) somehow intersects Fillmore's presupposition, as well as "implication". His casual mention of "the boy as the actor ("subject" of saw)", for instance (ibid., 210), shows his awareness of the "case" problem. And his proposals for "transformational" derivations of lexical items from N is Nclassifier sentences are relatable to Lyons's implication : e.g. the derivation of a sentence with "a large salmon" (or rather a discourse consisting of this sentence and one following, with a 'coreferential' item "The fish") from a pair of conjoined metalinguistic sentences including "a salmon is a fish" (ibid., 167).

The third type of adaptation of string analysis which has been attempted in this thesis consists of treating texts (the abstracts under investigation), including their titles, as conjoined sentences. The hypothesis underlying this attempt has been put forward by Katz and Fodor, though to my knowledge never explored by these or by other authors. In addition, I have extended Katz and Fodor's category of "sentential connectives" to include the period as well as other similar pauses of written discourse. Here again, Harris's well-known claims about the 'grammatical' nature, and about the neutrality of his discourse analysis operations towards semantic criteria is my reason for referring to Katz and Fodor rather than to Harris :

> In the great majority of cases, the sentence break in discourse is simply and-conjunction. (In others, it is but, for, or, and so on). Hence, for every discourse, there is a single sentence which consists of the sequence of n - sentences that comprises the discourse connected by the appropriate sentential connectives and which exhibits the same semantic relations exhibited in the discourse. (Katz and Fodor 1964, 490-1)

To sum up, the conception of surface structure delineated here is based on Sager and co-workers' published proposals for a restrictionless string grammar, though with two important qualifications. Harris's and his co-workers' conception is used only a means of handling the string aspects of discourse (i.e. the manifestation of discourse as a sequence of contiguous words) by setting up ordered sets of rules, operating on strings of 'grammatical' subcategories, and amenable to mechanization. Secondly, the reduction of the discourse strings leads to distinctive representations of the abstracts, which are represented by entries of the documentary concordance used as a metalanguage. Lastly, no attempt has been made to relate the surface structure representations thus set up to deep structures, because I found that an attempt along these lines is beyond the powers of current linguistic theories, at least as far as the problems discussed in this thesis are concerned. In other words, this thesis does not attempt to formulate transformational rules.

1.3.3. Structural semantics and deep structure representations based on logic.

After Lyons 1963, a structural approach to semantics can be defined as one in which linguistic meaning is not defined as such - in terms of (mostly controversial) psychological or philosophical conceptions about the 'nature' of meaning such as those mentioned in 1.1.5. but is defined instead in terms of empirically discoverable and verifiable facts, namely :

> as a function of (...) several relations (...). In other words, a is not synonymous with b because of its meaning; the fact of their synonymy is part of their meaning. (Lyons 1963, 58)

As Lyons has suggested, it is difficult to imagine how the meaning of such words as truth, beauty and goodness (or, if you wish, cancer, etc.) can be stated otherwise than within such an approach (Lyons 1968, 401). And, if this can be shown, the same will be true of any other word. Underlying Lyons's formulation is the logicians' principle of abstraction :

> What is the weight of a body ? It is usually conceived as an abstract property of the body, recognizable from certain physical effects. Using Russell's principle of abstraction we can reduce the concept weight to the relation having the same weight. The weight of a body is the class of all objects having the same weight as this body. An adept in traditional logic would object that in order to define the same weight we must first define the weight, and then proceed by addition of the differentia specifica to the genus. But there is no reason to insist on this impractical method. It is admissible to conceive the notion of the same weight as prior to that of weight and to define the latter in terms of the former. This conception corresponds to the actual procedure used in the empirical ascertainment of the weight of a body. The balance is a device which indicates, not the weight, but equality of weight. (Reichenbach 1947, 210, quoted in Lyons 1963, 58-9)

One of the most important recent developments in structural semantics has resulted from attempts made by several linguists and other students of language to extend and adapt "predicate calculus" or, perhaps more aptly, the calculus of propositional functions which logicians have set up, so that it can serve the purposes of semantic representation. Here, a few remarks about the linguists' terminology are necessary. Since the emphasis of the studies under discussion is on *extensions* of the logicians' framework, some terminological usages have resulted to which logicians would probably object, but which I suggest to regard as innocuous in linguistics - as long as the linguist is aware of them : for instance, the use made of such words as "sentence" and "proposition" for what would strictly speaking be regarded as a "propositional function" in the logicians' jargon.

> Going by some of the handbooks of logic with which I am acquainted (in particular Chauvineau 1962, and Gochet 1970b)"functional logic" or "the logic of propositional functions" is concerned with expressions (propositional functions) such as *x is red*, *x is the brother of y*, *x gives y to z*, or with "functions of functions" such as *X is more difficult than Y* (where X and Y stand for more elementary functions); the logician is particularly concerned with what in the form of these expressions is relevant to their truth-value. Functions are said to consist of "constants" or "predicates" such as *is red*, etc., and of one or more "terms" ("variables","arguments" : *x*, *y*, *z*, etc.). These can be specified (replaced by constants), and modified in various ways : by means of "quantifiers" (corresponding to natural language words such as *some*, *all*, *no*) or of more complex expressions (*there is some x such that*).

The adaptation of functional logic in TG linguistics has given rise to two main theories. One has been initiated by Fillmore, whose proposals will serve as a basis for Part III of this thesis, next to recent work on conjunction (in particular R. Lakoff 1970). The other trend is known as "generative semantics". This new form of TG theory has been developed by and around such linguists as George Lakoff, James McCawley, and Paul Postal. I shall not discuss "generative semantics" in this thesis or attempt to compare the new theory with Fillmore's, since such a comparative study would duplicate a recent paper of mine (J. Noël 1971) and would not be pursued in Part III, which is based on the rival theory proposed by Fillmore. Still, it is important to realize that the problems of semantic representation discussed in Part III could presumably have been approached on the basis of generative semantics, and that, if such an exploration of my problems on the basis of this theory were available, it would be possible to carry out an evaluative study of the two approaches - a task which, to my knowledge, has so far not been attempted systematically.

1.4. PROCEDURE

1.4.1. Towards a linguistic study of 'pragmatic' competence.

The question raised here is in what sense the semanticist's task can be described broadly as that of explaining "what underlies the use of the word *means* and related terms (...) in English and other languages" (Leech 1969, 5). In brief, I shall argue in favour of a linguistic study of 'pragmatic' competence, which in this study has its concrete counterpart in the proposal to consider *metalanguage*, *theory* and *procedure* as the main components of semantic analysis. Negatively, I shall argue that a notion of pragmatic competence should give up the following main features of Chomsky's notion of competence:

(i) the indeterminacy, discussed in 1.1.3., of Chomsky's metatheoretical conception of the boundaries separating the domains of linguistic and "pragmatic" competence, and of syntax, semantics, and "systems of knowledge and belief";

(ii) Chomsky's and his followers' commitments, mentioned in connection with the linguist's neutrality (1.1.5.), to various psychologically and philosophically controversial issues : in particular, Chomsky's negative attitude to communication, Katz and his associates' speculations about the universality of semantics, and Chomsky's mentalistic speculations on intrinsic or innate competence.

> Most recently, Chomsky (1969a, 83) put this as follows : "We may formulate the problem as the problem of determining the intrinsic characteristics of a device of unknown properties that accepts as 'input' the kind of data available to the child learning his first language, and produces as 'output' the generative grammar of that language. The 'output', in this case, is the internally represented grammar, mastery of which constitutes knowledge of the language."

(iii) the undue importance given by Chomsky to the difference between competence - establishable only on the basis of the linguist's introspection - and performance, and his misleading equation of other observable data with performance viewed as a range of facts of secondary importance for theoretical investigation, on the ground that competence in observable data is irretrievably distorted by such factors as "memory limitations, distractions, shifts of attention and interest, and errors " (Chomsky 1965, 3).

(iv) the practical equation (in his analyses) of "sentences" with theoretical objects ALWAYS yielding surface structures of sentences that are close to sentences in the everyday sense of the word, and his lack of concern with structures that would correspond to discourses (see the unexplored suggestion of Katz and Fodor).

Positively, however, I propose:

(i) to adopt Chomsky's conception of the linguist-observer's observations as facts of performance;

(ii) to recognize the existence of a 'gap', as it were (cp. Leech's expression "what underlies"), between the linguist-observer's performance and linguistic competence, a gap which Chomsky discusses in terms of the "creative" aspects of language, and which I have found useful to discuss below around a notion of "inaccessibility";

(iii) to define the "ideal speaker-hearer's linguistic competence" roughly as made up several competences, describable by the following formula : conceptual expertise statable by a metalanguage plus facts statable by linguistic theory equals 'competence';

(iv) to consider that competence thus defined is ideally describable by means of "precise and complete procedures" (Gardin), and that this goal, like any other scientific undertaking, is a sisyphean one (Gardin, personal communication).

In what follows, then, I would only agree with Chomsky's emphasis on "appropriateness", on the "creative" aspects of language, and on his consideration of the linguist-observer's observations as facts of "performance" serving as a basis for an account of competence as described above.

In brief, Chomsky has defined the task of linguistic theory as that of setting up rules accounting for an ideal hearer-speaker's competence, or "perfect" knowledge of the language. This is defined as an ability to produce and understand an indefinite number of "appropriate" sentences, including sentences never heard or spoken (or read) before. This competence is distinguished from performance, the way in which people actually use the language. The assumption is that performance can be defined at a later stage of research, in terms of departures from or differences with theoretically defined competence :

> Linguistic theory is concerned primarily with an ideal speaker-listener, in a completely homogeneous speech-community, who knows its language perfectly and is unaffected by such grammatically irrelevant conditions as memory limitations, distractions, shifts of attention and interest, and errors (random or characteristic) in applying his knowledge of the language in actual performance. (Chomsky 1965, 3)
>
> We thus make a fundamental distinction between competence (the speaker-hearer's knowledge of his language) and performance (the actual use of language in concrete situations). (*ibid.*, 4)

One of Chomsky's main concerns is how linguistic theory can provide "an explicit formulation of the "creative" processes of language", "a real understanding of how a language can (...) "make infinite use of finite means"" (ibid., 8), particularly of how language provides the means for "reacting appropriately in an indefinite range of new situations". One of the basic claims of this thesis is that the problem of the indefinite number of METAlanguages is one of the essential problems involved :

> an essential property of language is that it provides the means for expressing indefinitely many thoughts and for reacting appropriately in an indefinite range of new situations. (...) The grammar of a particular language, then, is to be supplemented by a universal grammar that accommodates the creative aspect of language and expresses the deep-seated regularities which, being universal, are omitted from the grammar itself. (ibid., 6)

Linguistic observations must be regarded as "data of performance", and :

> The problem for the linguist, as well as for the child learning the language, is to determine from the data of performance the underlying system of rules that has been mastered by the speaker-hearer and that he puts to use in actual performance. (ibid., 4)

To sum up, the purpose of this study is to exemplify and explore the suggestion that metatheoretical recognition needs to be given to the non-linguistic or conceptual foundations of linguistic competence, in the form of a metalanguage (or in some other form), and that "appropriateness", which I believe to be a central feature of competence, is theoretically statable by giving a primary place to conceptual facts in semantic studies. If it is to avoid being "trivial" and to drop "pretensions of omniscience" (Bolinger 1965), a conception of "creativity" and of the novelty of linguistic utterances - the other main feature of competence - will similarly have to recognize the conceptual foundations of linguistic competence. Among other things, it will have to account for creativity in science and literature : for instance, for the circumstances under which people can speak of machine translation (whatever the corresponding 'thing' or reference may be), or for the impact of people like Shakespeare and Chomsky on languages and sublanguages. While Chomsky's theory of syntax has stated and explored mathematical properties of language that account for creativity, I am not aware of the existence of equivalent proposals that would be relevant to the epistemological problems of people's conceptual or semantic creativity. Under these circumstances, I feel that the best thing to be done in these prolegomena is to describe the problem rather than attempt to offer solutions.

After the metatheoretical proposals outlined above and after Chomsky's conception of linguistic observations as data of performance, I shall go out from the communication situation which I propose to investigate in this study. The problem, as I wish to present it, concerns the inaccessibility of both object-language and metalanguage (though in different respects). The competence to be defined is the documentalist-indexer's or EXPERT-indexer's ability to represent the meaning of an indeterminate number of linguistically undefined abstracts in his field by means of one among other finite and linguistically definable metalanguages for this field. The problem of 'semantic' creativity is THE problem, but can hardly be touched upon, for lack of reliable knowledge in this area. Perhaps a solution will come from disciplines other than linguistics.

As I deputize for the expert in this study, my unachievable goal as an observer is a definition of competence on the basis of my observations of "only an inconsiderable subset" (Leech 1968, 94) of all possible abstracts on documentation. The object-language is 'inaccessible' in this sense. The inaccessibility problem, as it concerns both the object-language and the metalanguage, can be described by asking, with Stone (et al , 1966) :

> How can the infinite variety of words, phrases, sentences, and styles be the source of stable, scientific conclusions ? (ibid., 4)
> How does the investigator know when he has specified all the alternative ways in which a characteristic can be expressed ? He usually does not. On making further applications of his categories, he will often find new and unanticipated alternatives. He may fail to remember that certain words and phrases are signs of a social or psychological variable. He may also forget about the usages of a word or phrase under certain circumstances, which differ from those he has in mind. (ibid., 8)

Of course, "most of these errors can be avoided if the investigator collects a number of instances of actual word usage in context" (*ibid.*), but to do this only is to accept defeat, as the purpose of a theory is precisely to offer substitutes for data collection, and to predict what otherwise could only be obtained by observation of texts.

The inaccessibility problem with respect to the metalanguage is somewhat different. If we do *not* assume that the metalanguage consists, by definition, of a *finite* number of terms and relations and that these are available prior to the investigation, the inaccessibility problem is that of stating when, why and how the metalanguage will need to be changed. Assuming that the metalanguage *is* finite and fixed once and for all, as I have done in this study, there is still an inaccessibility problem in that we have no guarantee that the formulations of the metalanguage are the only, or the best possible ones, even with respect to a single 'class' of observers. Since the metalanguage used in the present study is a kind of classification consisting of definitions, the following passage from Langendoen on the question of dictionary definitions most appropriately illustrates the problem of inaccessibility as it arises here for the metalanguage.
It will be noted that Langendoen does not capture, or does not wish to use the notion of metalanguage. This notion, however, is obviously implicit in his reference to a "prescriptive (...) standard language", and in the statement he makes that "sentences only take on meaning upon conscious reflection", in the passage quoted above (in 1.1. 2) about "legal documents" belonging to *langue* :

> The experience of lexicographers (...) is that meanings for lexical items are extraordinarily difficult to pin down, even if dialect differences are overlooked (we may view the task of a lexicographer, at the risk of sounding prescriptive, as dealing with the meaning of an item in a standard language); one can almost never be sure that some element has been overlooked, or conversely that some superfluous material has been included. Alternative ways of defining items are almost always possible, and considerations of simplicity or elegance are often of no help in choosing among alternatives, and may be downright misleading. (Langendoen 1967, 107)

On several occasions, Gardin and co-workers have made similar observations about the metalanguages used in documentation. They point to the frequent difficulty of choosing between several possible relations among those defined in SYNTOL, the model which Gardin has set up for semantic representation in automatic documentation (Cros et al. 1964, 45-6). The authors of SYNTOL insist that, in many cases, none of the eligible relations can be said to be 'better' or more appropriate than any other. Similarly, it is difficult to say which metalanguage symbol is best for naming a given concept. In some cases even, a given natural language has no word corresponding to the metalanguage concept needed for documentary analysis : cp. "the absence of a word that bears to plants the relation that "corpse" bears to animals" (Chomsky 1965, 232).

The relevance of what has been said so far to the present thesis is most obvious in the many possibilities that exist of naming the very field to which the abstracts under investigation belong : (scientific and technical) information, documentation, information storage and retrieval, retrieval system theory, information science (and technology), scientific communication, knowledge availability, etc. While these expressions and many others (including various lengthy paraphrases and definitions) are often reducible to a single metalanguage unit, it is difficult to decide which expression best names the unit in question and, until the analyses presented in this thesis can throw some light on the problem, the only thing to do is to make an arbitrary choice, for instance in favour of "documentation", as I have done in what precedes. One of the crucial theoretical problems, under the conception so far described, is that of defining "dispersion factors" (Gardin 1969) that will account for one of the main symbolic aspects of people's 'metalinguistic' activities. It is the fact that a given metalinguistic unit or structure is broken up into formally different or more complex units or structures in the object-language, and vice-versa. It is a fact most dramatically observable in the traditional library practice of reducing a whole book to a handful of symbols drawn from a classification, and of using such a classification as a means of access to the knowledge shared by the members of our communities - and, indirectly, of extending this knowledge creatively.

1.4.2. From a linguist-observer's performance to competence.

I can now outline the ideal objective of this thesis as that of converting "observational" statements into an integrated set of other types of 'public' statements, in order to be able to describe the achievements and shortcomings of the present study with reference to such an ideal. This ideal, as far as the topic of this thesis is concerned, is the setting up of a "precise and complete" procedure based on a perfect linguistic theory, and relating a particular object-language (the English of abstracts on documentation) to one of the corresponding metalanguages (a classification concordance for the field of documentation) by means of "explicit" rules.

The empirically prior statements are "observational" statements (Leech) of the type illustrated in Figure 2. They express judgments of mine (for lack of approval or disapproval by competent informants) about the relations between texts of the object-language under investigation and the metalanguage used. This metalanguage is one of the possible definitions of the conceptual field of documentation. Its use, or the use of another for the same field, is indispensable in this study since linguistic theories are unable to define this (or any other) conceptual field and such a definition - as I have argued - needs to be made explicit as soon as one wishes to engage in a semantic analysis.

A brief actual example may be appropriate here to suggest what problems arise from the observational statements I go out from, and to illustrate the distinctive function of these observational statements. The example distorts my point only insofar as it can not illustrate the inaccessibility problems discussed in the preceding section : for a perfect illustration in this respect, one would need to consider all the entries of the classification used, and a perfect formulation of these entries and of their interrelations on the one hand, and the total possible set of abstracts in the field of documentation, on the other. Perhaps one would also need to consider what non-documentalist observers make of abstracts on documentation, however speculative the task may be. Here then, my example will consist only of two simplified classification entries - (1a) and (2a) respectively - and two corresponding abstracts (one of which is quoted only in part), (1b) and (2b) respectively. Thus, the observational statements which serve me as a starting point are illustrated by the relation I have established between (1a) and (1b) on the one hand, and (2a) and (2b), on the other. In other words, the a expressions are metalinguistic, the b expressions belong to the object-language, and the problem is how the relations established empirically between a and b can ideally be expressed in the form of rules.

(1a) Scientific and technical information institutions described individually.

(1b) The Japan Information Center of Science and Technology and its activities (title).
A general description of the Japan Information Center of Science and Technology which was established for the purpose of contributing to the development of science and technology by collecting, processing, storing, and retrieving scientific information (sentence 1 of abstract 1 : Janaske).

(2a) General organization of scientific and technical information.

(2b) Report on a study of scientific communications for the National Science Foundation (title).
This reviews the initial reasoning and thinking behind the design and construction of a project supported by the National Science Foundation, carried out by the Operations Research Group at the Case Institute of Technology to determine ways "to affect the behavior of scientific institutions that are responsible for the dissemination of recorded information in order to achieve a net improvement in scientific productivity."(text of abstract 2, consisting of a single sentence : Janaske).

PART II : AN EXPERIMENT IN MECHANIZED INDEXING.

2.1. INTRODUCTION.

2.1.1. Background and objectives.

The mechanized indexing system presented here was developed at the University of Victoria between May 1968 and May 1969. Preliminary tests, which were run between September 1967 and May 1968, will not be reported here, since they are described elsewhere (my unpublished M.A. thesis : J. Noël 1968) and have been superseded by the present system. This system has analyzed the first 50 abstracts of the Janaske bibliography (Janaske 1962). The edited version of these 50 texts as they were actually processed by the computer is appended (Appendix 3). The unedited version of the first 5 abstracts of the Janaske collection is quoted in Appendix 4, that is, the version in which they actually appear in Janaske with bibliographic information which was not punched on cards and with various other types of information which were edited out before and during the punching (see 2.2.2.). The main entries ('groupes') of the Gardin-Lévy concordance which serves as a metalanguage in this study are quoted in Appendix 1. My own English translation of the main headings of this list of descriptors is given in Appendix 2.

Henceforth, I shall abbreviate my references to the Janaske bibliography as follows : (J 1) will mean '(quoted from) abstract 1 of the Janaske corpus', etc.

The computer programmes written for the mechanized indexing system will not be described here. They were written in PL-1 for the IBM 360/44 computer of the University of Victoria. The programmer, Rémi Michelot, has so far not published his programmes. Here, I shall therefore only report on my own work, which consisted of setting up a system that could be programmed during the time available, on the basis of the metatheoretical assumptions presented in Part 1 and of considerations to be discussed presently.

First, I must point out that the system presented here has not been set up in a real retrieval situation (on this, Salton 1968). In particular, I have not been able to have my indexing (2.2.1.) checked by users in an actual retrieval environment.

Furthermore, no computerized syntactic analyzer or indexing system has been available to me during or after the setting up of the system. Nor have I been able to make use of a ready-made computerized dictionary of documentation English; in fact, I do not know of the existence of such a dictinnary in the literature. Under these conditions , I decided to set up my own system, and to do this on the basis of various preliminary simplifications and assumptions.

The main preliminary simplifications which were decided are the following :

(i) The experimental corpus was limited to fifty abstracts in their edited version as given in Appendix 3.

(ii) As descriptors, I used my English translation of the main headings of the Gardin-Lévy concordance (Appendix 2), and these descriptors were left unanalyzed and treated as a single symbol. As a result, it was possible to reduce the problem of indexing to that of representing each abstract of the experimental corpus by one descriptor (only occasionally more than one) treated as a single symbol, and to reduce the problem of mechanized indexing to that of 'translating' each abstract into a single code (see 2.4.9.) standing for this (these) descriptor(s).

(iii) Many automatic syntactic analyzers and indexing systems are set up in such a way that in a given situation the machine can choose between a number of decisions, some of which can be judged to be wrong by informants. Thus, all known syntactic analyzers produce several analyses for a given sentence, and only some of these analyses can be described as 'syntactically' and/or 'semantically' 'correct'. Similarly, Bély et al.,who have published the largest and most sophisticated automatic indexing experiment known to me, have included in their final report an evaluation study in which various "correct" and "incorrect" computer outputs are discussed (Bély et al. 1970, Ch. 6 and Ch. 12). In the experiment presented below, I have adopted a different approach. From a computational point of view, the purpose of the experiment was to mechanize a system which was previously set up and tested manually and which, from the outset, was assumed to produce the 'correct' output. As it appeared from the manual tests and from consultations with computer experts that the system worked and was programmable, the programmes were written and the system was run successfully from beginning to end on the computer. As a computational experiment then, the system is a complete success, thanks to the devotion and (for me, most instructive) cooperation of the programmer. The only qualification is that, within the year available for the experiment, it was not possible to integrate all the operations performed by the system into a single programme. Thus, in the system as it stands, human intervention is necessary to use the tape with the output of one stage of the system as input to the next stage.

(iv) For practical reasons, it was not possible to test the system with abstracts outside the experimental corpus, for instance some of the remaining 1121 abstracts of the Janaske corpus.

As for the *linguistic* aspects of mechanized indexing, the system under discussion was set up to test an approach to mechanized indexing which can be described as follows :

(i) The sentences of a text can be represented for computer processing *as grammatically defined strings of CONTIGUOUS word classes*, and a text can in turn be represented *as a string of contiguous sentence strings*. This is a conception of language most clearly formulated by Harris. More broadly, the assumption of contiguity can be regarded as a basic postulate of linguistics, *and* as a prerequisite for assuming that language data are computable. If, for instance, a rule states that a string consists of *A* and *B*, no other symbol is allowed between *A* and *B*, and the computer is programmed to recognize just the string *AB*. In one of Harris's recent formulations :

> Talk or writing is not carried out with respect to some measured space. The only distance between any two words of a sentence is the sequence of other words between them (...) Hence, the only elementary relation between two words in a word sequence is that of being next neighbors (...) Any well-formedness for sentence structures must therefore require a contiguous sequence of objects, the only property that

> makes this sequence a format of the grammar being that the objects are not arbitrary words but words of particular classes (...) But the sequence has to be contiguous; it cannot be spread out with spaces in between, because there is no way of identifying or measuring the spaces (Harris 1968, 16).

The "elementary relation" referred to by Harris is *concatenation*, and will be symbolized as + , as in '*A+B*' standing for a string *AB* . '*A+B*' means that *A* is immediately followed by *B*.

(ii) From (i), it follows that, by means of concatenation rules, a text can be represented as a single string, consisting of smaller strings. The concatenation rules are based on a grammar : "the only property" that makes the sequence of words in sentences and in texts "a format of the grammar" is that the words are "not arbitrary words but words of particular classes" (Harris, *loc. cit.*). Because the grammatical concatenation of word classes is the only fact about the surface structure of language that can be assumed to be true of any language variety, it was found that the mechanized indexing system presented below would achieve greatest generality by being based essentially on this fact. Moreover, even under a conception of language which distinguishes between semantic deep structure and grammatical surface structure, a treatment of the concatenation facts of surface structure is a *necessary* (though not sufficient) *condition* for an analysis of language data.

(iii) In agreement with the requirement of *distinctiveness* discussed in Part 1, the concatenation rules are stated for "*subclasses*" (such as N_{mol} for "proteins" in biochemical language : Harris 1968, 153) rather than for classes (such as *N* for Noun) holding for the language as a whole. This raises the problem of subcategorization. Irrespective of this problem, the string grammar set up for the system under discussion is of the "restrictionless" type, that is, one which states dependencies of subclasses - with a resulting increase in the number of categories and of string formulas (Salkof and Sager 1967).

(iv) In the system, the problem of subcategorization is separated from that of setting up concatenation rules. In other words, the problem of subcategorization is treated as one of dictionary-making which is independent of the system proper. In this way, the dictionary codes can be changed or improved without affecting the general organization of the system. For obvious computational reasons, however, a format for lexical codes had to be fixed in terms of the maximum number of characters which lexical entries can consist of. I believe that there are good reasons for adopting this treatment of subclasses. I feel that lexical problems in general, and problems of subcategorization in particular, are the most poorly known area of linguistic theory. Besides, I have not succeeded in setting up a satisfactory approach to subcategorization for my mechanized indexing system, as will appear from the discussion of subcategorization presented below (2.3.).

(v) No known theory is able to predict the length - either minimal or maximal - of the strings that serve to express a given meaning. In particular, as far as the present study is concerned, there is no way predicting or deciding a priori which strings of the abstracts under investigation will correspond to a given entry or descriptor of the meta-language. In the system, this matter has therefore been treated as a descriptive problem, and has been left open to further research. To take just one well-known example of the difficulty alluded to here, consider abstract J 36 (Appendix 3), whose last sentence contains a negation denying some of the information implied by the preceding sentences (see section 3.3.4. on "implication"). Because of this difficulty, I decided to set up the system in such a way that the machine would have to analyze all the words occurring in each text, thus leaving open the question of the size of the strings that can be associated with a given descriptor.

(vi) By virtue of the definition given above of indexing as the reduction of a text to a single symbol, the various stages of the system do not only serve to concatenate strings of grammatical classes. Their function is also to delete information. The loss of information which takes place during the process of indexing - particularly so-called indicative indexing of the type adopted for this study - is indeed one of the problems which needs to be faced in any mechanized indexing experiment : obviously, one or two descriptors are unable to represent all the meaning of a text. The problem is how to symbolize this loss of information, in spite of the difficulties just mentioned in (v). This problem has also been treated as a descriptive problem in the present experiment, because it is beyond the predictive power of current theories.

In this thesis, I shall not attempt to improve directly on the treatment of subcategorization and of semantic units adopted in my mechanized indexing experiment. I shall assume that the lexico-semantic problems involved are more fruitfully dealt with on the basis of a conception of semantic deep structure than in terms of an extension of string theory. The essential purpose of Part III of this thesis is to suggest ways of remedying the semantic shortcomings of the mechanized indexing experiment on the basis of recent work by generative linguists on problems of semantic representation.

2.1.2. Synopsis.

In brief, the mechanized indexing system works as follows. After a dictionary-lookup operation which replaces each text word or symbol by a code, the machine performs step-by-step concatenations of these codes, rewriting two or more codes as a single code by looking up lists of rules stored in it, until each abstract is rewritten as a single code. After dictionary-lookup there are in total 10 main sets of concatenation rules, which apply in succession. Each set of rules makes use of the results of the preceding set of rules. The ten sets of concatenation rules are based on only four types of operations performed by four computer programmes, three of which are used more than once.

The programme which is used only once has the effect of replacing some proper nouns by a general label for proper nouns : thus, "the National Science Foundation" is rewritten as 'NPP' standing for 'proper noun'.

Using letters (A, B, C, etc.) to represent the codes which the machine concatenates, the operations performed by the other three programmes can be explained as follows.

The first programme concatenates only two codes at a time and works from left to right. It can, however, operate in several passes, each of which makes use of the results of the pass that precedes. Thus a string ABC is processed in two passes. In a first pass, B and C are concatenated : B + C. In a second pass A is concatenated with B + C, yielding A + B + C. Alternatively, A can be concatenated with B, and AB with C.

The second programme concatenates pairs of codes between which there is a code for a conjunction or for some category equated with conjunction. Thus, writing small c for conjunction, this programme concatenates strings of the type AcB, yielding A + B. The rewriting (A + B) obtained by a first concatenation can be concatenated with a following conjoined code. Thus, an enumeration AcBcC can be rewritten in two passes as A + B + C. This programme works from left to right : it begins by testing for the occurrence of a first c, then it tests for the occurrence of an A preceding and of a B following this c.

The third programme concatenates between six and two codes : A + B + C + D + E + F, A + B + C + D + E, A + B + C + D, A + B + C, A + B. The first pass processes strings of six codes, the second strings of five, the third strings of four, the fourth strings of three, and the fifth strings of two codes.

In order to simplify the presentation, I shall now refer to each successive set of concatenations performed by the three programmes just mentioned as a series of 'grammars' : respectively G.0 ('grammar 0'), G.1, G.2, G.3, G.4, G.5, G.6, G.7, and G.8. The following table (1) summarizes the workings of the system, and the various operations it performs. The arrow (-->) stands for 'is rewritten as' (the exact meaning of this rewriting operation in the system will be explained later).

(1)

ORDER OF OPERATIONS: TYPE OF OPERATION:	1	2	3	4	5	6	7	8	9	10	11
Dictionary lookup: text word-->code	X										
Some proper nouns -->NPP		X									
Pass 1:BC-->B+C Pass 2:AB+C-->A+B+C Etc.			G.0				G.4				
Pass 1:AcB-->A+B Pass 2:A+BcC-->A+B+C Etc.				G.1		G.3			G.6		G.8
Pass 1:A...F-->A+...F . . . Pass 5:AB-->A+B					G.2			G.5		G.7	

As appears from this table, the 'conjunction reduction' programme operates after each of the other concatenation operations except G.4.The last application of this programme serves to concatenate the codes obtained for the title and the sentence(s) of each abstract, the code for the period being treated as a conjunction.

On the basis of the conventions adopted in table (1), I can now outline the rest of this presentation. The next chapter is devoted to the work that was done to prepare the system (2.2. PREPARATORY WORK). This chapter is subdivided as follows : Indexing (2.2.1.), Punching and editing (2.2.2.), and System design (2.2.3.). The third chapter is entitled SUBCATEGORIZATION AND DICTIONARY LOOKUP (2.3.).

Chapter 2.4. is a description of the main components of the system. The first section deals with the analysis of proper nouns (2.4.0.). The remaining sections (2.4.1. to 2.4.9.) explain the workings of the various 'grammars' that operate after the reduction of proper nouns, namely G.0 to G.8. In the last chapter, I shall present sample analyses and draw conclusions (2.5.) concerning what I believe to be the pros and cons of the system, and possible ways of improving on it.

Throughout the presentation of the system, I shall try to concentrate on general problems and principles and to select significant examples rather than give an exhaustive description of the system, because such a description would require several hundreds of pages. As a matter of fact, our experiment turned out to be a very large one indeed. The complete computer printout for the system represents two big volumes of machine lists. It took me a whole week to reduce these lists to fifty tables giving a synoptic analysis of each abstract of the experimental corpus (such a synoptic analysis has not been programmed, as pointed out in the preceding section), and I have found that even these fifty tables which give the successive rewritings from G.0 to G.8 are too large and too complex to be presented as such in the ensuing report. This is the reason why I decided to break down my account into the various chapters and subdivisions ~~outlined~~ mentioned in the preceding paragraph.

2.2. PREPARATORY WORK.

2.2.1. Indexing.

As a preliminary step towards the setting up of the mechanized indexing system, I indexed the 1121 abstracts of the Janaske bibliography. I felt that this was necessary for me to gain familiarity with the texts, and with the field of documentation. Here, however, I shall only report on the indexing of the 50 texts of the experimental corpus, which are listed in Appendix 3 in their edited version. My indexing of the 50 abstracts is tabulated below in (6).

The 25 main headings of the Gardin-Lévy concordance which were used as descriptors in this study are given in Appendix 2. Those that were used to index the abstracts of the experimental corpus - in total 12 descriptors - are listed below in (2) (a) with the number assigned to them by N. Gardin and F. Lévy. In (2) (a), STI stands for "scientific and technical information". Following a suggestion made by N. Gardin and F. Lévy, I have merged number 9 (Techniques of reproduction) into number 23 (Machines and equipment). Abbreviations of the headings of (2) (a) which will be used in table (6) below are given in (2) (b).

(2)

(a) 1. STI : generalities.
2. Professional problems.
3. Information science
4. Related sciences.
5. General organization of STI.
6. STI institutions.
7. Functioning of STI networks.
8. Sources of information.
10. Information handling : generalities.
16. Classification and indexing.
19. Coding.
23. Machines and equipment.

(b) 1. GEN(eralities).
2. PROF(ession).
3. SCI(ence).
4. SCO(other sciences).
5. GEN(eral) ORG(anization).
6. INST(itutions)(= individual institutions).
7. FUNCT(ioning).
8. SOURCES.
10. HAND(ling).
16. CLASS(ification).
19. COD(ing).
23. EQUIP(ment).

Before reporting on the results of my indexing, I wish to mention some difficulties which I experienced in indexing.

The first difficulty, which has already been mentioned in 2.1.1. has to do with the size and nature of the strings of discourse which can be said to correspond to a given descriptor. As an example, consider abstract J2, which is quoted below in (3) together with the descriptor assigned to it.

(3)

(a) Report on a study of scientific communications for the National Science Foundation.

This reviews the initial reasoning and thinking behind the design and construction of a project supported by the National Science Foundation, carried out by the Operations Research Group at the Case Institute of Technology to determine ways to affect the behavior of scientific institutions that are responsible for the dissemination of recorded information in order to achieve a net improvement in scientific productivity. (J2).

(b) Descriptor : General organization of STI.

Let us assume that the text is aptly represented by the descriptor "General organization of STI" : while the expression "*scientific communications*" in the title is ambiguous (for reasons to be discussed in Part III, particularly in 3.3.4.), the expression "*the behavior of scientific institutions that are responsible for the dissemination of recorded information*" is relatable to the descriptor in question, and to its definition (Appendix 1, "Groupe 5"). What is unclear (and will be left undiscussed in the rest of this thesis) is how and why the *rest* of the text allows for, *and* does not preclude, the interpretation in question. In other words, even though one can identify in the text a *passage* which is directly relatable to the descriptor assigned to the text, there is no known way of determining the contribution of the rest of the text to the meaning of the 'significant' passage in question. To return to the simple example given above, the text would not have been assigned the same descriptor if the passage about "*scientific institutions*" had been the grammatical object of, say, "*The author does NOT discuss—*" (rather than of "*...determine ways to affect——*").

A second difficulty (and another problem left undiscussed in this thesis) concerns the assumption just made about (3). As already pointed out, I have not attempted to analyze the headings of the Gardin-Lévy concordance, that is, I have not analyzed the French definitions, nor the general headings of Appendix 1, nor the English translation of these headings given in Appendix 2, nor the relations between the headings and the definitions. Obviously, the passage "*the behavior of scientific institutions that are responsible for the dissemination of recorded information*" (J2) (in particular the plural "institution*s*") is more directly relatable to the *definition* of "Groupe 5" (Appendix 1 in particular

"Ensemble des organismes et institutions qui forment l'appareil général de l'IST, dans un ou plusieurs pays...") than to the heading "General organization of STI", and it would be necessary to analyze the inference process by which we relate the heading, the definition and the corresponding expression in the object-language. I have not attempted to do this because I have found no theory that could throw light on this inference process : such a theory, for instance, would have to show the relation between grammatical marks like plural ("institutions", "organismes") and words like "general", "ensemble", etc. Another example of the same difficulty is J32 which has been indexed by the descriptor "STI : generalities". In the definition of this heading, mention is made of "considerations concerning the future of scientific information" (Appendix 1, Groupe 1). The use of the future tense in the text is one of the clues (next to vague, everyday adjectives like "fast, large" in 4) for describing its topic as "generalities", rather than, say, as scientific considerations about "memories" and storage devices (as in the case in J11, Appendix 3). The last sentence of J32 is quoted below in (4) :

(4)

> Machine translation of languages and recognition of spoken information are two other areas which will require fast, large memories (J 32).

Part III of this thesis concentrates on problems that are common to the metalanguage and to the object-language, but does not clarify the nature of relations that are intuitively establishable between metalanguage and object-language such as those just exemplified.

A third difficulty which I have experienced in indexing is even more serious : I am uncertain about the correctness of my indexing of some abstracts of the experimental corpus. These 'difficult' abstracts will be marked below with a question mark (?). As an example, consider J18 quoted below in (5) in its unedited version :

(5)

> Application of high-speed computers
> to information retrieval.
>
> This is a description of the following types of information retrieval systems : statistical, syntactical and interrelational. In addition, the computer research program of the Patent Office--HAYSTAQ-- is described. (J18).

The title has a very general meaning, while "statistical, syntactical and interrelational" in the text suggests that the topic of the text is narrower : presumably describable as "Classification and indexing". In such cases, I decided to assign to the text the broadest possible descriptor, in this case "Information handling : generalities".

The occurrence of "computer research program of the Patent Office -- HAYSTAQ" in (5) exemplifies one last difficulty I wish to mention in connection with indexing. Unless one has the necessary expertise to know what HAYSTAQ is, "computer research program" is ambiguous in various ways. "Program" can mean either "project" or "computer program" in the sense of routine.Besides "computer research" is ambiguous between research ABOUT and research WITH(the aid of) computers. If HAYSTAQ is left out, as has been done in the edited version of J 18 (Appendix 3; see next section), there is no way of resolving the ambiguity.

In (6) below, I have tabulated my indexing of the 50 abstracts of the experimental corpus. In order to avoid duplicating Appendix 3, I merely give passages of the abstracts in column 1,when there is a short passage - such as a title - that is rather obviously relatable to the descriptor chosen. The descriptors are given in the abbreviated form of (2) (b). The extracts quoted in column 1 should not be regarded as the 'significant' passages of the texts they are drawn from; as already pointed out, the size of a 'significant' passage cannot be safely specified or predicted in the current state of linguistic theories. An attempt will be made, however, in Part III of this thesis to approach the problem via the notion of 'topic' developed in Chapter 3.2.

(6)

DESCRIPTORS : EXTRACTS WITH Nr of ABSTRACT :	GEN	PROF	SCI	SCO	GENORG	INST	FUNCT	SOURCES	HAND	CLASS	COD	EQUIP
The Japan Information Center...and its activities (J1)						X						
scientific institutions that are responsible for the dissemination of recorded information (J2)					X							
the National Institutes of Health Russian scientific translation program (J3)						X						
problems of a manufacturer ...in searching for information in the medical and chemical literature (J4)							X	X				
The Federal Government and U.S. scientific information (J5)					X							
United States scientific and technical information services (J6)					X							
documentation centers in the German Democratic Republic (J7)					X							
Training the scientific information officer... syllabus...for a... course of training...(J8)		X	X									
the IBM 650 information retrieval system which uses the inverted file (J9)												X (?)

(6) (continued)

DESCRIPTORS : / EXTRACTS WITH Nr. of ABSTRACT :	GEN	PROF	SCI	SCO	GENORG	INST	FUNCT	SOURCES	HAND	CLASS	COD	EQUIP
the present state of biological literature(J10)							X					
magnetic drums,...punched ... tapes..., ... patent documentation problems (J11)							X					X
logically cataloging knowledge... binary-octal designations (J12)										X	X	
Searching the chemical literature (J13)							X					
current research... in documentation (J14)			X									
Advances in EDP and information systems (J15)			X									
Technical communication in psychology (J16)							X					
evaluating scientific information retrieval systems (J17)			X									
(J18) : see (5) (?)									X			
Automatic categorization of chemical concepts and interrelationships (J19)										X		
Interrelationships as a basis for information retrieval (J20)										X		
preparing an inverted file (J21)												X

(6) (continued)

DESCRIPTORS : EXTRACTS WITH Nr. of ABSTRACT:	GEN	PROF	SCI	SCO	GENORG	INST	FUNCT	SOURCES	HAND	CLASS	COD	EQUIP
Patent Office searching (J22)									X (?)			
work at the... Laboratory of Machine Translation (J23)				X								
universal code of science (J24)										X		
Swiss documentation (J25)					X							
(J26) (?)			X									
(J27) (?)									X			
establishment... of a system for handling informal literature(J28)					X							
establishment of an international technical information system (J29)					X							
Directory of data processing service centers (J30)					X							
aeronautical documentation in the ...NATO countries (J31)					X							
(J32) : see (4)	X											
classification for the literature of documentation (J33)			X							X		
conference...for effective documentation systems (J34)			X									
Automatic selection and reproduction of industrial documents (J35)									X (?)			X

(6) (continued)

DESCRIPTORS : / EXTRACTS WITH Nr. of ABSTRACT:	GEN	PROF	SCI	SCO	GENORG	INST	FUNCT	SOURCES	HAND	CLASS	COD	EQUIP
the Automatic Microfilm Information System (J36)									X (?)			X
design and construction ...of...a memory...a camera...an output system (J37)												X
Introduction to scientific documentation (J38)			X									
The Yugoslav Bibliographical institute (J39)						X						
Scientific literature use (J40)							X					
House organs and trade publications as information sources (J41)							X	X				
medical information in the Soviet Union (J42)					X							
Growth of chemical literature...Activity of Chemical Abstracts (J43)						X	X					
Soviet science information service...VINITI (J44)					X	X						
Hungary's network of technical libraries (J45)					X							

(6) (continued)

DESCRIPTORS : EXTRACTS WITH Nr. of ABSTRACT:	GEN	PROF	SCI	SCO	GENORG	INST	FUNCT	SOURCES	HAND	CLASS	COD	EQUIP
relationship of the library to society... information centers in Czechoslovakia (J46)	X				X							
documentation in West Germany (J47)					X							
Rapid Selector program of the Bureau of Ships (J48)									X (?)			
(J49) (?)			X						X			
microreproduction equipment... high capacity storage and retrieval and data management (J50)				X								X

2.2.2. Punching and editing.

A further step towards the setting up of the mechanized indexing system was the punching and editing of the texts. The 1121 abstracts of Janaske were punched on standard eighty-column punched-cards. The editing was carried out both before the punching and during the proof-reading of the cards. It was decided to punch the whole of the Janaske corpus in order to be able to prepare various types of word lists and indices.

Here I shall concentrate on the editing of the experimental corpus, and I shall not discuss the punching procedure or the production of indexes, since such a discussion is not necessary for the understanding of what follows. About the punching operations, however, I wish to mention three points, which are relevant to the design and organization of the system.

First of all, it was decided to limit the number of punching conventions to a minimum. For example, the German preposition "für" in "Institut für Dokumentationswesen" (J47) was punched "FUR" (see Appendix 3), and names which are written with capitals in Janaske such as "NATO" (J31) and "VINITI" (J44) were punched as if they had been written as "Nato" and "Viniti", that is, treated as capitalized words (see below). Similarly, the division of two abstracts of the experimental corpus into paragraphs (J34, J37) was ignored in the punching.

Second, all numerical indications (in a broad sense) were punched with an asterisk preceding, as exemplified below in (7). This was done with a view to a preliminary simplification which is performed at the dictionary-lookup stage : at this stage, all symbols preceded by an asterisk are replaced by a single code, namely NUM. This undoubtedly results in a loss of information but also in an important simplification : it is no longer necessary to enumerate all cardinal and ordinal numbers, and compounds containing them, both in the form of digits (e.g. 5, 5th) and in the form of the corresponding words (e.g. five, fifth). Such a solution, of course, requires that the keypunch operator knows the language : consider, for instance, the homograph "second". The only numeral which was not punched with an asterisk is "first" (not "1st"), because it can be used as an adverb as in "First (of all)", "At first", etc.(+) "Binary-octal" (J12) was also treated as an ordinary word. Examples of the symbols treated as numerals in the experimental corpus are given below :

(7)

(a) Examples : *BILLIONS (J32),
*EIGHTY-COLUMN (J35), *SECOND (J37),
*SEVENTH (J15), *SIX-POINT (J5),
*THREE-SYMBOL (J26), *TWENTY (J35),
*0.3 (J37), *1ST (J38, J44),
*104,484 (J43), *1957-1958 (J14),
*2ND (J38, J50), *9800 (J43).

(b) Dictionary-code : NUM.

Third, all capitalized words were punched with an asterisk following : for instance, AMERICAN* (J13, J28, J33), WESTINGHOUSE* (J35). The asterisk is used in the dictionary-lookup (2.3.) and proper-noun reduction (2.4.0.) operations discussed below.

(+) Cp. the treatment of "one": 2.3.3

The editing was also performed with a view to various preliminary simplifications. Not being an expert in programming, I am unable to say to what extent what was achieved by editing could have been done by means of appropriate computer programmes. What is clear, however, is that the problems which were solved in this study by editing are serious ones if one imagines their solution in a fully automatic system that would have to process language data as they appear in their printed form, with all its orthographic and typographic variations - both systematic and unsystematic : if, for instance, the texts were put in machine-readable form by means of some reading-machine.

Whatever the elegant solution to these problems may be, we found it expedient to solve them by editing, considering that we had only one year available to us to carry out our mechanized indexing experiment. Moreover, it was found that, even if the problems could be solved by stating additional rules in the system, such a solution would result in an unnecessary overburdening of the system.

Part of the editing was done by crossing out various types of information in the copy of Janaske used by the keypunch operators. The rest was done during the proofreading of the cards, by punching again the cards containing data that we did not wish to be processed by the computer. The following types of information were changed or deleted :

(i) Bibliographical information about the abstracted document. Compare the facsimile reproduction of the first five abstracts in Appendix 4 with their edited version in Appendix 3. Thus, the name of the author (ACKOFF, R.L.) and In ... in J2 were not punched. Nor was the indication ©, ADI appearing after some of the abstracts. Similarly, original titles in German, Russian, etc., were left out.

(ii) Wrong or inconsistent spellings. Consider, for instance, "dessemination", second occurrence of "dissemination" in J 5 , Appendix 4. An example of inconsistent spelling is the capitalized "The" in the Janaske version of J30 : "in Canada and The United States". This was normalized into "the" and punched "THE". A similar normalization was decided for the two occurrences of (the)Federal Government in J5 : in Janaske, one is capitalized, and the other is not (Appendix 4). The two occurrences have been punched with asterisks in the edited version (Appendix 3).

(iii) Other normalizations and deletions. Whereas there is normally no space in print between various punctuation marks such as comma, period, etc., or the mark of the genitive ('s) and what precedes, these symbols were punched as distinct symbols and could thus be treated like words at the dictionary-lookup stage.

Various typographical signs which are listed below in (8), were edited out :

(8)

(a) Quotation marks : " "
(b) Points of suspension, as after etc.: etc...
(c) Various indications in enumerations :
    (1)(2)(3) and the equivalent Roman I. II. III.
(d) Dashes : - -
(e) Brackets.

Some dashes were punched as commas as in "the third element - machine languages" (J24). "IBM 650" was hyphenated and punched as a proper noun (J9). All that was between brackets or dashes was either deleted or changed, as is shown in (9) :

(9)

(a) computer research program of the Patent Office -- HAYSTAQ -- is described. (J18)
(a') COMPUTER RESEARCH PROGRAM OF THE PATENT* OFFICE* IS DESCRIBED .
(b) Two of the elements needed - terminological systems and symbolic languages - already exist. (J24)
(b') TWO OF THE ELEMENTS NEEDED ALREADY EXIST.

(c) in the pertinent geographical region (German, French, Italian). (J25)
(c') IN THE PERTINENT GEOGRAPHICAL REGION : GERMAN* , FRENCH* , ITALIAN*

Lastly, various bibliographical data appearing in the texts of some abstracts were edited out : for instance, ", by B.E. Holm, p. 64-74" at the end of J15. In only two abstracts (J15 and J33) out of fifty, the various normalizations and excisions reported in this section have resulted in drastic modifications of the printed versions of the texts. The titles and texts of these two abstracts are quoted below in (10) as they appear in Janaske, and this unedited version can be compared with the edited one given in Appendix 3 (incidentally, note a punching error in "AMA's", J15). Note that most of these drastic changes are due to the occurrence of bibliographical information in the printed version of these texts. In fact, in the absence of such information, little or no editing was found necessary.

(10)

(a) Advances in EDP and information systems.

Papers in this volume are "based on material originally presented at AMA's Seventh Annual Data Processing Conference, held in March 1961". Partial contents : Advances in information retrieval and data acquisition: I. Progress in the design of information retrieval system, by M. Taube, p. 51-63; II. Improved information storage and retrieval systems, by B.E. Holm, p. 64-74.

(b) A suggested classification for the literature of documentation.

The classification scheme presented here had its origin in a class project undertaken by students at the University of Chicago, Graduate Library School during the spring quarter 1960. A description of the principal features of the classification with reference to David J. Haykin's six basic building rules for special classification is followed by 2 appendices: I. Classified Guide to American Documentation 1950-1960, vol. I-XI; II. Suggested classification for the literature of documentation.

2.2.3. System design.

In this section, I wish to discuss two points which concern (i) the theoretical foundations and (ii) the general strategy of mechanized indexing. My reason for bringing the points together here is that are related as far as the historical background of my experiment is concerned, and they both concern decisions which were crucial for the design of the system as it was actually set up.

Concerning the theoretical foundations, I must stress the fact that during the actual design and development of the system a number of conditions were absent which, had they been met, could have changed the theoretical orientation of my experiment; in fact, some of these conditions are still not met at the time I am writing this thesis.

First, it was not possible for me to adopt and explore the methods proposed by the Gardin group and reported in Bély et al. (1970), even though a pre-publication version of their report was available to me in due time. The research of the Gardin group hinges on semantic representations in terms of the SYNTOL model (Cros et al. 1964 and 1968), and even the Gardin group which has been much concerned with the field of documentation has so far not attempted to develop SYNTOL descriptors or extensions of the SYNTOL syntax for the field with which I am concerned (see N. Gardin and F. Lévy 1967). I myself have not attempted to analyze the Gardin-Lévy concordance in terms of the SYNTOL model (my only attempts towards an analysis of this concordance appear in Part III).

Second, most of the other linguistically oriented studies in automatic indexing which I have heard of were not available to me in detailed reports during my experiment. Even if they had been, they could not have been exploited in my work. Some of them, in particular the research of the Salton group with the SMART system and Sager's String Program, would have required computer programmes which have never been available to me : for instance, the Kuno-Oettinger analyzer used in the SMART system (Salton in Hays 1966, 180). Other American projects had published studies which were either based on a very crude syntax (Stone *et al*. 1966), or were - and, as far as I can see, still are - based on metatheoretical assumptions which are not compatible with those presented in Part I - in particular, with my concern with a fairly large corpus of actual texts in relation to an actual list of field-specific descriptors. The following is quoted from the conclusions of a state-of-the-art report by Simmons entitled "Natural Language Question - Answering Systems : 1969"; the two publications (out of a list of 79) mentioned by Simmons as going beyond sentence boundaries have never been available to me :

> Significant weaknesses are still prominent. All existing systems are experimental in nature, small, and corebound. None uses more than a few hundred words of dictionary or a small grammar and semantic system. None can deal with more than a small subset of English strings. Deductive operations, though undeniably powerful, still generally lack adequate heuristic controls to limit the extent of searching an infinite inference tree. Little has been done so far to incorporate inductive inference procedures. Few systems (see Charniak and Wilks) go beyond sentence boundaries in their analyses, and generally acceptable methods for anaphoric analysis and the discovery of prohominal reference have not yet been developed. Such subtleties as the relativity of adjectives and adverbs, thematic sequence, metaphor, etc., have still to be explored. (Simmons 1970, 28-29).

Third, Part III of this thesis was prepared after my mechanized indexing experiment was completed, and most of the theoretical sources on which that part of my thesis is based appeared at the time the system was developed, or were not available to me in due time for them to affect the design of the system.

As to what I have called the general strategy of mechanized indexing, the decisions which underlie my experiment are best explained with reference to those that underlie the experiments of the Gardin group reported in Bély et al. 1970, since theirs is the only automatic indexing system I know that is based on metatheoretical assumptions similar to mine. The main issue here, I believe, is the respective place of semantic and grammatical considerations in the actual development of a computerized indexing system. Since any actual system necessarily emphasizes one aspect at the expense of the other, I feel justified in reducing the issue to a conflict between two rival strategies. One is best explained by quoting the first sentence of a paper by Sager; the other, by quoting from a paper by J.C. Gardin, which was read in 1964, at a time when the Gardin group based their automatic indexing system entirely on semantic information.

> Writers of programs for handling natural language material, whether for mechanical translation, automatic indexing, or other purposes, have learned (sometimes the hard way) that without grammatical analysis their efforts at processing language data reach an early limit. (Sager 1967, 153).

> ... observons ici encore l'analogie avec la traduction mécanique, où l'on distingue de la même manière entre la mise en oeuvre d'un dictionnaire automatique pour le choix des mots, et l'application d'un algorithme d'analyse et de synthèse grammaticalespour l'expression des relations logiques entre ces mots.
>
> C'est sans doute en raison de cette analogie que l'on a souvent abordé "l'analyse automatique", en documentation, par le biais de l'analyse syntaxique des textes naturels, le raisonnement implicite paraissant être que celle-ci était en tout état de cause nécessaire à celle-là. Rien cependant n'est moins évident : en premier lieu, il n'est pas rare que l'on se contente en pratique d'une représentation par descripteurs seuls,

> sans indications syntaxiques, auquel cas l'algorithme d'analyse grammaticale perd une partie de son objet (...) En second lieu, lorsque des indications syntaxiques sont requises, elles sont souvent en fait si pauvres (par exemple, un simple repérage de liens non interprétés entre certains descripteurs pris 2 à 2 ou *n* à *n*) que l'on peut se demander si l'analyse logique intégrale des textes d'entrée n'est pas un outil disproportionné à la tâche. Enfin, et surtout, il est connu que la reconnaissance des structures syntaxiques ne permet elle-même de résoudre qu'une partie des difficultés de traduction, au point que l'usage s'est établi d'annoncer toujours une phase ultérieure d'*analyse sémantique*, qui devra "compléter" la précédente, "supprimer les ambiguïtés résiduelles", etc. Malheureusement, cette phase finale n'est jamais décrite, autrement que dans son principe; et si ce dernier paraît en général fort simple - il s'agit toujours, sous une forme ou une autre, de la "résolution par le contexte", déjà citée - l'application n'en demeure pas moins problématique (...) les données linguistiques et extralinguistiques nécessaires pour mener à bien cette analyse sémantique risquent en fait d'être si complexes que l'on est dès lors tenté de les employer non plus comme "complément" des données grammaticales, après une analyse syntaxique déjà coûteuse, mais comme "substitut" de celles-ci, pour mener à bien l'interprétation syntaxique généralement sommaire que l'on vise en documentation. (J.C. Gardin 1966, 120).

The Gardin team have since then made use of more and more grammatical information. Their system, as described in the final report by Bély *et al.* 1970, is based on a complex interaction of grammatical and semantic analysis procedures, at the stages of both "lexical" and "syntactic" indexing. Thus, at the "lexical" stage, some types of word groups are translated into SYNTOL descriptors partly on the basis of grammatical procedures : one serves to select the appropriate part-of-speech category (e.g. adjective or noun for "complexe" : *op. cit.*, 27), and another, which works in combination with semantic analysis, establishes some syntactic relations : for instance, the relation of an adjective to the noun it qualifies (*op. cit.*, 31).

At the "syntactic" stage, which serves to establish the nature and orientation of some SYNTOL relations holding between the descriptors obtained at the "lexical" stage, both parts-of-speech categories and some syntactic relations are used once again together with semantic information. Thus, the machine can operate on the basis of syntactic templates ("schémas syntaxiques") for establishing a given SYNTOL relation from the various possible grammatical structures that correspond to it : for instance "... provoque ...", "... qui provoque...", "... que provoque...", "... provoqué par...", etc. (*op. cit.*, 103). This grammatical information can be complemented by semantic information, obtained by looking up tables (a so-called semantic or notional network) specifying *a priori* the SYNTOL relation that can hold between two descriptors and between the corresponding natural language words : for instance, in an expression like "the effect on A of B", the relation established between A and B will not be the same for A = *sleep* and B = an *animal* as for A = an *animal* and B = some *chemical*, and no grammar is able to predict such a fact.

When designing my system, I made the following decisions which can be regarded as a compromise between the extreme 'grammatical' approach represented by Sager's statement, and the exclusive reliance on semantic analysis as in the first experiments of the Gardin group :

(i) I decided to give primacy to surface grammar and found that my system should be based essentially on rules that make use of parts-of-speech categories of the type proposed by Harris in string theory, and similar to the grammatical codes used by Bély *et al*. 1970 and many others (in particular Hornby's "Patterns" : Hornby 1954). I also found that Harris's string theory was the most explicit treatment available of surface facts of concatenation, and the one which, because of its explicitly algebraic formulation, best lends itself to computational analysis, and to an 'autonomous' treatment of what Chomsky regards as (derived) surface structure.

(ii) I decided to define the tasks of the various 'grammars' in the system in terms of grammatical relations (including adjunction), but *not* to let the machine establish, or operate with, symbols for these relations, such as the *Subject+Verb+Object* formula which defines the notion of center string (Harris 1965, 24; cp. Bély *et al.* 1970). My first reason for leaving grammatical relations implicit is a practical one : I felt that this additional dimension could not be introduced into the system within the time available for the experiment. Besides, as pointed out in Part II, the concept of center string is of questionable semantic validity. Moreover, the concept breaks down in "semi-articulate" ("Thank you !") and "inarticulate" ("Thanks !") sentences (Jespersen 1965, 308; see 3.2.3.).

(iii) Subcategorization (2.3.) is handled by dictionary codes which can be changed or improved and is thus left open to further investigation. Similarly, the concatenations and rewritings in the various 'grammars' of the system are based on manipulations of codes which could be improved (or even changed altogether, if texts in another field were to be processed) WITHOUT affecting the general organization of the system or requiring changes in the computer programmes. This strategy by which (for lack of a better solution) some crucial theoretical questions are left open is, I believe, a sound one in computational work, because one cannot afford to take the risk of wasting programming and machine time by setting up a system hinging on aspects of linguistic analysis that obviously require further research (see Part III).

This, I must stress, should not be interpreted as a criticism of Bély et al.'s experiment. Their situation was different from mine in that they had both SYNTOL descriptors and the SYNTOL syntax around which they could organize their experiment. They have developed a most interesting approach to problems of discourse structure (in particular, their use of various types of contexts to establish some descriptors, and their "raccordement" : Bély et al. 1970, 30 and 117). But their approach is based on the SYNTOL framework which has so far not been applied to the field of documentation.

(iv) My system has been defined as one which works from (object-language) surface structure to (metalanguage) surface structure, and, more precisely, as one which reduces the longer strings of the object-language to the shorter strings of the metalanguage. The essential function of the system is therefore to reduce long strings to short ones. This means that the longer and often more explicit expressions are (progressively) replaced by equivalent short and mostly less explicit, symbols. Consequently, by analogy with TG theory, the system can be described as one that transforms texts into semantically relatable noun-phrases. The reduction process is parallel to various similar processes which can or could be stated about the object-language : for instance, a long noun-phrase with a relative clause such as "the... Center... which was established for the purpose of collecting, processing, storing, and retrieving scientific information" is relatable and reducible to the noun-phrase "the documentation center" which, being shorter, is closer than the other to the metalanguage descriptor. The purpose of the system presented below is to mechanize such reductions on the basis of concatenation rules, and the purpose of Part III of this thesis is to throw some light on the semantics that underlies these reduction processes, and the converse possibility of expressing in a sentence or in a text what can partly be expressed by a shorter string.

2.3. SUBCATEGORIZATION AND DICTIONARY-LOOKUP.

2.3.1. Introduction.

The dictionary presented in this chapter was set up in order to enable the computer to replace over one thousand different word tokens occurring in the experimental corpus by codes consisting of no more than 15 characters. Not all of these thousand words were assigned a specific code in the dictionary. Thus, most of the capitalized words, which were punched with an asterisk following, were left uncoded and were replaced mechanically by the code NOT CODED (see the treatment of proper nouns below, in section 2.4.0.). Similarly, the words that were punched with an asterisk preceding, that is, numerals and words relatable to them, were automatically replaced by the code NUM. In this chapter, I shall not be concerned with the words replaced by NOT CODED and by NUM. I shall only deal with the others.

As pointed out in 1.3.2., the dictionary was set up on the basis of proposals made by Salkof and Sager 1967 concerning a *restrictionless string grammar*. This is a string grammar whose rules state ~~dependies~~ dependencies of subclasses or subcategories. These dependencies are intended to be restrictionless, as against the dependencies of more general classes like those used by Harris in the first version of string theory (Harris 1965): for instance, *A* for adjective and *N* for noun. Thus, one can assume that a string formula *AN* is not restrictionless in the sense that any adjective cannot co-occur with any noun. A restrictionless string grammar, then, can be defined ideally as one whose rules or formulas have no exceptions.

The purpose of this chapter is to explain how I set up the subclasses or subcategories for my experiment, what kind of subclasses were set up, and what are the consequences of my approach.

The task of setting up a dictionary is by no means an easy one. As far as the experiment under discussion is concerned, there were some additional difficulties. The number of words to be examined was large (over a thousand) and the time available for doing this was short : since dictionary-lookup comes first, it was the first operation that had to be programmed and tested, so that only a few months were available for the setting up of the dictionary, and even some of this time had to be devoted to the general design of the system and planning of the experiment. The dictionary codes which were eventually set up are therefore extremely tentative, as will appear from the ensuing account. Moreover, I have made generous use of a convention (the period symbol, explained below) which amounts to saying that for a given word I have been unable to set up any kind of motivated subcategory. This, I suggest, was the most reasonable thing to do considering the time that could be devoted to the dictionary codes.

In addition, I must point out that I am unable to explain how I arrived at my dictionary codes in terms of any formal procedure, or to present arguments for or against my codes. Such a procedure does not exist, as far as I can see : Katz and Postal, for instance, would equally be unable to explain how they establish relations between markers on the basis of the category inclusion relation mentioned in the passage quoted below. In my opinion, the method that would come closest to a formal procedure for setting up lexical subcategories would have to make use of Lyons's and Leech's work on implication (see below, section 3.3.4.) or of Harris's proposals about the concept of "vocabulary classifiers". "The vocabulary classifiers are the last N in sentences of the form X is a (member of, or : case of, etc.) N (...) E.g. (...) a salmon is a fish" (Harris 1968, 166-7). What is by no means clear in Harris's suggestion is the nature of the predicate or relation, in the logician's sense of the word : note the "etc.". Moreover, it seems to me that Lyons's implication relation is more general and interesting than Harris's N is Ncl proposal, because implication holds between sentences and can therefore involve other grammatical classes than N.

What I have NOT attempted to do in my experimental subcategorizations is best explained by referring to Katz and Postal 1964. I have not attempted to set up dictionary entries which are claimed to be valid in the whole of a language or to reflect "linguistic universals":

> The formulation of a dictionary for the semantic component of a particular language can be greatly economized by taking advantage of a relation between certain pairs of semantic markers. The relation that serves this purpose is the category inclusion relation which holds between a pair of semantic markers when the category represented by one is a subcategory of that represented by the other. For example, the semantic marker (Human) represents a conceptual category that is included in the categories represented by (Animate), (Higher Animal), (Physical Object), etc., but the category that the semantic marker (Physical Object) represents is not included in any of these aforementioned categories. These category inclusion relations will be specified within the general theory of linguistic descriptions as part of that theory's statement of the semantic concepts that are linguistic universals when such a statement is a true generalization about the structure of the dictionary for every linguistic description. (Katz and Postal 1964, 16).

Following suggestions made by Harris 1968, and contrary to Katz and Postal's emphasis on universal or language-independent properties of the dictionary, I have attempted to set up subcategories that capture what is specific or distinctive about the English of abstracts in the field of documentation, and about categories of abstracts as established by indexing.

In short, then, the application made in this study of the concept of restrictionless string grammar has two aspects. One is the aspect envisaged by Harris, Salkof and Sager and concerns the statement of dependencies between subclasses of words by means of string formulas. This aspect is the one which is most directly relevant to computer recognition : once the dictionary-lookup programmes have replaced the text words by codes standing for subcategories, the computer can scan the strings of codes in order to recognize those strings which match exactly a rule or string formula stored in its memory, and the recognition can proceed without any restrictions.

The other aspect concerns the way in which the descriptors (and some additions made to them, see below), and therefore also the concatenation rules which serve to eventually reduce the texts to descriptors, determine the nature of the subclasses or subcategories which were adopted for the codes. To take an example based on the above passage from Katz and Postal, the word "psychologists" (J16) in the corpus under investigation need not and should not be characterized by markers such as (Animate), (Higher Animal), (Physical Object). The marker (Physical Object), for instance, would presumably be 'relevant' to an analysis of say, "psychologists who weigh more than 200 pounds" which can be assumed to be impossible in abstracts on documentation, and such a marker is irrelevant to the analysis of a sentence (and of the abstract) in which the word actually occurs in the experimental corpus : "psychologists should attend immediately to the problem of encyclopedic organization of their knowledge..." (J16). I do not mean to suggest that the theoretical status of what I have just called 'relevance' is clear. All I wish to do here is to raise my problem on a sound empirical basis, rather than on an obviously incorrect one. To me, at least, such concepts as (Physical Object), (Higher Animal), etc., cannot be associated with "psychologists" in the above sentence and cannot be automatically assigned by the theory to the semantic representation of this sentence, and it is important to go out from such facts.

Details about my attempt to let the dictionary codes be determined by the indexing will be given in the next section (2.3.2.). In particular, I shall explain my attempt to let the degree of generality of the subcategories be determined by the indexing, rather than have for a given word an indeterminate number of categories included in one another, as Katz and Postal would propose : I assume that, for instance, a machine or theory which computes "THE THING IS ON THE THING" from the sentence "The cat is on the mat" is too indiscriminate for the distinctive purposes of indexing.

With a few exceptions to be mentioned below, the codes that were set up for the words occurring in the experimental corpus consist of two parts. These two parts correspond to the kind of notation proposed by Harris and mentioned in 1.3.2. for sentences such as "The polypeptides were washed in hydrochloric acid". The first part represents categories "recognized in the whole language", such as the following in

Harris's formula for the above sentence : *N is Ven in N.* The second part corresponds to the subscripts (for instance, N_{mol} and N_{sol}) which Harris uses to "name particular subclasses" "recognized (...) only in the science sublanguage" (Harris 1968, 153). Like Harris's notations, my dictionary codes are abbreviations of ordinary words. Such abbreviations were necessary to stick to the 15-character coding format just mentioned.

To simplify the presentation, I shall henceforth refer to the first part of my codes as a *category* (cp. Harris's *Ven*) and to the second part as a *subcategory* (Harris's subscripts). To make the codes used in the experiment more readable, these two parts were separated by a bar (/). Thus ACTIVITIES was coded NPL/ACT.; NPL stands for Noun Plural, and the period (.) indicates that the notation is an abbreviation of the actual graphical form of the coded word.

The use of the period symbol in the experiment was not always justified or consistent. I believe that it was, however, in two types of situations. One can be exemplified by the name "Chemical Abstracts" (J43). It is essential for the system to identify and analyze this name correctly in order to be able to index abstract J43 by means of the descriptor STI INSTITUTIONS. The period symbol assigned to the codes for CHEMICAL* and for ABSTRACTS* serves to express the fact that these codes stand for the words "Chemical" and "Abstracts" and nothing else.

The other important use of the period symbol is the following. Whenever I felt unable to assign a subcategory to a word (and this turned out to be very frequently the case) the graphical shape of the word was used (occasionally in abbreviation) as the code and marked by a period : for instance, the code NSG/COR/E. for the word "core". In the following section, I shall not give a complete list of the words coded in this fashion. Such a list would be of no interest, since I am unable to say why I could not subcategorize the words in question. I shall just mention a few other examples here, because they will appear in an illustration given below in 2.5.1. : "service(s)" was just assigned the subcategory coded as SER/VIC.; "operation(s)", the subcategory OPE/RTN.; "science", the subcategory SCI.; and "information", the subcategory INF..

2.3.2. Nouns, adjectives, and verbs.

The categories assigned to nouns are given below in (11), column 1; in column 2, I indicate and exemplify what the code stands for. Note that these types of codes are in agreement with the concept of restrictionless grammar and that, thanks to such codes, it is possible to do without a procedure for morphological analysis. All words which can only be adjectives were labelled ADJ.

(11)

NAA	proper noun or adjective : RUSSIAN* (e.g. in Russian)
NAM	'name', i.e. proper noun; or adjective: AFRICA*, SWISS*
NPL	noun, plural: ACTIVITIES
NSG	noun, singular: EFFORT
NSP	noun, singular or plural: DATA (only example)
NXX	noun, or some other category: SUBJECT
N2G	noun, or ing-form: BEGINNING
N2P	noun plural, or verb in 3rd person: WORKS
N2S	noun singular, or verb in another person of the present tense : WORK

The grammatical status of homographs such as N2P was established by rewriting rules : for instance, the concatenation of "this" with the following "reviews" serves to establish that "reviews" is a verb in J2 (see G.2., below).

Homographs which were coded under the general heading Adjective, are of the following types :

(12)

A2N	adjective or noun: FUTURE, INDIVIDUAL, etc.
A2V	adjective or verb: DIRECT, COMPLETE, PRESENT (which could have been coded A3), etc.

Examples of the effect of indexing on the subcategories chosen for the experiment are the codes GEO/NAT, standing for 'geographical, national', and GEO/INT, standing for 'geographical, international'. GEO/INT was assigned to words such as the following : "foreign" (ADJ/GEO/INT), "international" (ADJ/GEO/INT.), "Europe", "Africa", "Nato" (NAM/GEO/INT), "abroad" (N+P/GEO/INT:N+P stands for preposition+Noun), etc. GEO/NAT was assigned to such words as "national" (ADJ/GEO/NAT.), "country" (NSG/GEO/NAT), "Swiss", "Switzerland" (NAM/GEO/NAT), etc. Now, as appears from 2.2.1., heading 5 of Gardin-Lévy ("General organization of STI") is the best represented descriptor in the experiment : 14 abstracts out of 50 are represented by means of this descriptor, and part of its definition, which is quoted in Appendix 1, reads : "Ensemble des organismes qui forment l'appareil général de l'IST, dans un ou plusieurs pays, un ou plusieurs domaines d'application". The 'geographical' codes given above and their degree of generality were adopted to match the underlined portion of this definition. Several codes set up for the final reduction of the abstracts to a single code (in G.8) consist of two parts : one symbolizing Gardin-Lévy's heading and the other some additional information. In the case of the abstracts described by "general organization of STI", the final code consisted of the indication NETWRK (standing for the above heading: 'network of STI institutions') and, if necessary, of the indications NATION ('national') or INT ('international') next to other additional indications. Thus, J25 which is subtitled "Guide to Swiss documentation" was eventually reduced to the code NETWRKNATION, and J29 which concerns "a proposal for the establishment of an international technical information system" was reduced to NETWRKFUTINT (where FUT stands for 'future').

Also in connection with the descriptor NETWRK, I wish to mention the subcategory INS standing for 'institution'. When a noun thus subcategorized is plural, it directly matches the plural in Gardin-Lévy's definition of "Network of STI institutions". Consider the following examples : "organizations" (J14, J42), "bureaus" (J30) (both coded NPL/INS), "institutions" (J2, J25, J38, J47 : NPL/INS.), "libraries" (J25, J38, J40, J45, J46), "archives" (J25) (both coded NPL/INS/DOC, i.e. 'documentation institutions'), "branches" (J46; NPL/INS/PAT, i.e. 'part').

Another example of the way in which the indexing determined the nature of the dictionary codes is the abstracts described by the heading "Functioning of STI networks", which is also a frequently used descriptor in the experimental corpus (Gardin-Lévy's heading N° 7 : eight abstracts). In the final rewriting for the abstracts, this heading was symbolized as FLO, standing for 'flow of information'. Part of the definition for this heading reads : "Circulation de l'IST (...) appréciations sur le fonctionnement des réseaux d'information considérés au groupe 5". Now, the reference to the field of application in the definition of Group 5 just quoted ("un ou plusieurs domaines d'application") turned out to be one of the characteristics of abstracts described by FLO. Examples are the titles of J4 and J13 : "Searching medicinal chemical literature" (J4), "Searching the chemical literature" (J13). When applicable, this reference to the field was added to FLO in the final rewriting of the abstracts in the form of the code DIS, standing for "in a particular discipline". This was done for J4, J10 ("Storage and retrieval of biological information"), J13, J16 ("Technical communication in psychology") and for J43 ("Growth of chemical literature"). This symbol DIS served to subcategorize adjectives such as "chemical", "medical", etc. (ADJ/DIS), "industrial" (ADJ/DIS/BUS, i.e. 'business'), nouns such as "chemicals" (NPL/DIS/TOP, i.e. 'topic of a discipline' as in "a manufacturer of fine chemicals"; J4), "specimens" (coded like "chemicals"; "storage and retrieval of biological specimens" in J10), "compounds" (coded like "chemicals"; J22), "psychologists" (NPL/DIS=AGT, i.e. 'agent'; J16), "psychology", "chemistry" (NSG/DIS), etc.

The topic FLO can also be expressed by references to the documents whose 'flow' or 'circulation' is considered, as in "patent documentation" (J11), "scientific literature use" (J40), and in "acquisition and handling of house organs and other trade publications" (J41). The code ITM ('item'), with occasionally an additional code such as TYP ('type') and PAT ('part'), was used to subcategorize words for various sorts of documents; the code ITM was used in order to avoid the code DOC which is used for other purposes explained below. Examples of words subcategorized by the code ITM are : 'paper' and 'article' (ITM); 'item' (ITM.); 'pages', 'appendix', 'chapter' (ITM/PAT); 'disclosures', 'patents', 'memoranda', 'drawing', 'organ', 'journal', 'prescription' (ITM/TYP); 'collections', 'holdings' (ITM/VAG, i.e. 'vague', standing for 'mass noun') and 'literature' (ITM/VAGLIT.).

One last way in which indexing determines the nature of the dictionary codes is worth mentioning here in connection with certain nouns and adjectives. It has to do with various losses of information which take place in indexing. Thus, certain words are, or seem to be, irrelevant to indexing. However poorly understood this loss of information may be, and however dangerous it may be to effect this loss of information in the dictionary codes, it was decided to do so for a number of words. Thus, adjectives like "net", "fine", "broad", "basic", "modern", were assigned the subcategory QAL standing for 'some qualitative indication', and adjectives such as "finite", "entire", "many", "linear", "countless", "low-cost", the code QAT standing for 'some quantitative indication'. Occasionally, a code was added to these general subcategories, but these additional codes are in general too arbitrary to be worth mentioning here. Similarly QAL was used to code nouns like "advantages" and "aspects", and QAT for nouns like "prices", "rates", "feet". No QAL or QAT codes appear in the final rewritings for the abstracts established in G.8 and explained in the relevant section of the next chapter. Nouns like "behavior", "efforts", "tasks" were indiscriminately subcategorized as ACT, a code also used for "activities" (ACT.), and nouns like "consideration", "preparation", "creation", "generation", as DEV, the subcategory used for "development" (DEV.). Like QAL and QAT, the codes ACT and DEV do not appear in the final rewritings of the abstracts.

A particularly important subcategory, which was used for quite a number of verbs and cognate nouns, is the code DOC. It served to subcategorize words for various activities in the field of documentation : "acquisition" (DOC/COL), "documentation" (DOC.), "classification" (DOC/CLA.), "dissemination" (DOC/DIS.), "retrieval" (DOC/RTR.), "storage" (DOC/STO.), code (N2S/DOC/COD.), "search" (N2S/DOC/SCH.), "file" (N2S/DOC/STO), "abstracting" (VNG/DOC/ABS.), "cataloging" (VNG/DOC/CAT.), "collecting" (VNG/DOC/COL.), "gather" (DOC/COL). As will be noted, the above codes make generous use of the period symbol. This means that I did not wish to commit myself to any systematic subcategorization of the words in question during the mechanized indexing experiment. I felt that the problems involved could be more usefully examined in the semantic part of my investigation (Part III).

Finally, I wish to mention the subcategory STU, which was used to code various words which serve to *introduce* the topics of the abstracts but of which I assumed that they do not serve to *express* these topics. These words, which are also discussed in Part III of this study (chapter 3.2) include the following : "*deliberations*" (STU), "*observations*" (STU/OBS.), "*discussion*" (STU), "*investigation*" (STU), "*description*" (STU/DES. in which the specification DES. is intended to predict the special use of "*describe*" as in the word '*descriptor*'), "*evaluation*" (STU/QAL), "*studies*" (N2P/STU.), "*measures*" (N2P/STU/QAT), "*traced*" and "*outlined*" (VED/STU). Another subcategory which was assumed to be related to STU is SAY, which was assigned to such verbs as "*purport*", "*conclude*", and "*state*".

I shall not present any further subcategory set up for the experiment, either because I feel that they are too tentative and arbitrary to be of interest, or because they are not dealt with in Part III. All the subcategories that are worth mentioning for verbs have been mentioned above in connection with cognate nouns.

The grammatical categories used for verbs are listed below:

(13)

VED	For instance, UNDERTAKEN, ACHIEVED
VNG	For instance, DEVELOPING, PREPARING
VPL	For instance, REQUIRE, MAKE
VSG	For instance, FEELS, SHOWS
VXX	V, VED, VPL or Noun : CUT (only example)

The codes for forms of '*to be*' and a few other verbs are presented in the next section.

2.3.3. Other categories and codes.

Special codes were set up for categories other than Nouns, Adjectives and Verbs, and for words which have special properties. These special codes are listed below in (14). The codes consisting of X plus the graphical shape of the coded word (see below) were set up for the same reasons as those which dictated the use of the period symbol : either they occur in phrases or phrase-like constructions (cp. "*as well as*" and "*Chemical Abstracts*"), or no category can be safely assigned to them ("*as*" is a good example), or both ("*as well as*").

(14)

A	For A and AN
THE	For THE
ALL	For ALL
ANY	For ANY
ADV	For adverbs such as ALREADY, ALSO
ADX	For adverbs such as ONLY, PARTICULARLY
CC	For semi-colon
CR	For OR
C1	For comma
C2	For AND
KL	For colon
S	For period
P...	Prepositions. For instance PBY, for the preposition BY.
PS	For 'S, the mark of the genitive
X...	See below.

A difference was made among adverbs between ADV, ADX, and adverbs that are subcategorized because of their assumed importance for indexing. The latter include : "*manually*", "*automatically*", "*mechanically*", and "*logically*". Some adverbs were coded ADX because observations showed that they could be followed, or preceded (or both) by punctuation marks such as comma. These adverbs were deleted by concatenation rules in G.0 (see below). They include : "*particularly*", "*however*", "*especially*", and "*today*". The adverbs coded ADV were deleted by a special subroutine which will be discussed later. The purpose of the codes CC, CR, C1, C2, KL, and S is also explained below in Chapter 2.4.

The words whose code consists of X followed by the word in question are listed below (15), without the X and in alphabetical order. They often belong to more than one category. The categories they belong to include subordinate conjunction, adverb, verb (to be, to have, modals in their various forms), possessive and demonstrative pronoun and adjective, personal and relative pronoun, and negation.

(15)

ABOUT
AFTER
AHEAD
ALTHOUGH
ARE
AS
BE
BECAUSE
BEEN
BEFORE
BEING
CAN
EACH
ETC
FAR
HAD
HAS
HAVE
HAVING
HE
HIS
HOW
IF
IS
IT
ITS
LEAST
LESS
MAY
MERELY
MIGHT
MORE
MOST
MUCH
MUST
NO
NOR
NOT
OFF
ONE
ONES
OTHER
OUR
OUT
OVER
SHOULD
SINCE
SO
SOME
SUCH
THAN
THAT
THEIR
THEM
THEN
THERE
THESE
THEY
THIS
THOSE
UNLESS
US
VERY
WAS
WELL
WERE
WHAT
WHATEVER
WHEN
WHICH
WHO
WILL
WOULD

2.4. DESCRIPTION OF THE SYSTEM.

2.4.0. The processing of proper nouns.

By proper noun is meant here not only nouns but, by extension, any capitalized word. The procedure set up for the processing of proper nouns is based on the following considerations :

(i) there exists to my knowledge no grammar of proper nouns.
(ii) the list of proper nouns is open-ended.
(iii) a distinction needs to be made among proper nouns between those that are required for the purpose of indexing and those that are not, however difficult such a distinction may be.

On the basis of these considerations, I set up a procedure for the treatment of proper nouns which I think is the most general and most fully automatic procedure in the system. It works as follows. Capitalized words, which have been punched with an asterisk following, can be given two types of codes in the dictionary-lookup operation. Some are assigned a code standing for a specific semantic class : for instance, "Japan" is coded NAM/GEO/NAT standing for Proper noun, geographical, national. Others are replaced by NOT CODED, which means that the dictionary does not contain a code for them : for instance, "Center" is replaced by NOT CODED.

When a capitalized word occurring with no other capitalized word has been replaced by NOT CODED, THE+NOT CODED is in turn replaced in the proper noun reduction procedure by the code NPP standing for proper noun : for instance, in "the BSA" (J 16) BSA is replaced by NOT CODED, and THE NOT CODED by NPP. Otherwise, if the capitalized word has been replaced by a semantic code, this code is not processed by the proper noun procedure : for instance, "U.S." occurring in "particularly among U.S. scientists and engineers" (J 5).

Compound proper nouns, that is, those consisting of more than one capitalized word, are handled as follows. If at least one NOT CODED appears in the corresponding string of codes obtained by dictionary-lookup, all this string, including the definite article that precedes, is replaced by NPP : for instance, "the National Science Foundation" (J 2). If all the constituents of a compound proper noun have been replaced by semantic codes, these codes are handled by the rest of the system; this is the way I have treated "American Documentation" (J 33), "Chemical Abstracts" (J 43), "the Federal Government" (J 5) and various names of countries such as "the German Democratic Republic" (J 7), because I assumed that they were important for indexing.

A further distinction needed to be made among compound proper nouns between those that consist of only capitalized words following the article ("the National Science Foundation") and those in which some non-capitalized word or symbol occurs between the capitalized words : for instance, "the Japan Information Center of Science and Technology" (J 1). In order to also reduce the latter type to NPP, the programme was written so that the machine would disregard the occurrence of the non-capitalized 'words' by looking up a list of these 'words'. The list for the experimental corpus is given below in (16). A summary of the proper noun procedure is tabulated in (17).

(16)

,
.
)
and
at
for
fur (J47)
in
of
the

(17)

Type :	string with at least one NOT CODED	Yes : replaced by	No : replaced by
One-word		NPP ("the BSA",J16)	semantic code ("IBM-650", J9)
Many-word	with a 'word' of list (16)	NPP ("the Board of Scientific Affairs, J16)	semantic codes ("Chemical Abstracts", J43)
	without	NPP ("the National Science Foundation, J2)	

It seems to me that the advantages of the procedure outweigh its disadvantages. Its main advantage is that it makes it possible to process strings that are unpredictable. Besides, it results in important reductions of the abstracts under analysis, because of the great number of proper nouns in these texts. The inclusion of certain items in list (16) - in particular, comma, semi-colon, AT and THE - results in drastic reductions which are worth mentioning here. Thus, the inclusion of AT and THE permits the reduction to NPP of the whole string "the Operations Research Group at the Case Institute of Technology" (J2). The comma has been included in the list because it can have a value similar to AT; for instance, each of the following strings was also reduced to NPP thanks to the inclusion of the comma in list (16) : "the Library and Information Service, Paint Division, Imperial Chemical Industries Limited" (J27), "the University of Chicago, Graduate Library School" (J33). The inclusion of AND may result in the lumping together (the reduction to a single NPP) of two or more proper nouns, but I have found that the amount of reduction achieved justified this lack of delicacy : "the U.S. Patent Office and the National Bureau of Standards" (J22). Similarly, the addition of semi-colon to the list results in important reductions at the expense of delicacy; thus, the following two strings could both be reduced to a single NPP : "the International Federation for Documentation; the Joint Engineering Council; the German Documentation Society; and the Gmelin Institute of Inorganic Chemistry and Related Sciences in the Max-Planck Society for the Advancement of Science" (J34), "Bibliographical; Reference and Documentation; International Exchange of Publications Centre; and Technical Printing Division" (J39).

Only in one text has the procedure resulted in a clearly wrong analysis, namely a wrong segmentation. The underlined portion of the string "the National Institutes of Health Russian scientific translation program" (J3) was reduced to NPP because "National", "Institutes", and "Health" were replaced by NOT CODED in the dictionary-lookup procedure. Still, as "Russian" is replaced by a semantic code and appears in the title ("Problems in communicating Russian science") the information contained in "Russian" could be preserved.

Loss of information is the price which needs to be paid for the important reductions and simplifications achieved by the procedure. I have found, however, that this price is worth paying and that the reduction of most proper nouns and capitalized expressions to NPP did not seriously affect the indexing, even though it raises a problem. The problem can be explained by returning to the example given above. After application of the proper noun reduction procedure, the beginning of abstract J3 has a coded form equivalent to (18) :

(18)

> Problems in communicating Russian science.
> An outline of NPP scientific translation
> program (...) (J3).

For such strings, I have assumed that, when this is required for indexing, the semantic status of NPP can be inferred from the context, that is, established by some later rule in the system. Thus in the above example, I have assumed that the status of NPP as some institution (rather than some person or some name of a machine or system) can be established on the basis of the concatenation of the string "of NPP scientific translation program" (in G.2 : section 2.4.3.) and can be confirmed by the rest of the text. This is just an assumption or working hypothesis. Compare the treatment the string "the Rapid Selector program of the Bureau of Ships" (J48) in which "Rapid Selector" was replaced by semantic codes, while "the Bureau of Ships" was reduced to NPP.

I do not wish to claim that all the assumptions I have made are correct. There are other thinkable strategies than the one I have adopted here : for instance, one could leave the ambiguity of NPP unresolved. For lack of reliable knowledge about the inference processes involved in examples like the above, I prefer to leave the question open.

2.4.1. G.0

G.0 refers to the first set of concatenation rules operating immediately after the proper noun reduction procedure. As already pointed out G.0 works schematically as follows. It concatenates only pairs of codes, but can operate in several passes, one pass treating the rewriting obtained in the preceding pass or passes as a single symbol. For instance, B is concatenated with C, yielding the rewriting B+C, which can then be concatenated with A to yield the rewriting A+(B+C). From now on, I shall adopt the convention used in this abstract example : I shall represent the result of a first concatenation as in B+C and give the result of one or more preceding concatenations between brackets, as in (B+C). As far as possible, I shall represent the operations of G.0 and of the following 'grammars' by quoting the actual words rather than the corresponding codes that were actually processed or obtained by the machine in the experiment; these codes would obscure rather than clarify my presentation, which is centred on the ordering of sets of concatenation rules, rather than on the codes on which the machine operates. Unless otherwise specified, the rewritings resulting from the concatenations preserve the information conveyed by the concatenated symbols. When this is not the case, the word corresponding to the information that has been preserved is underlined in the lists given below. In this section, the concatenations performed by G.0 in the experimental corpus are listed exhaustively.

The purpose of G.0 is to prepare the operation of the following 'grammars' by reducing certain strings of codes to a single code. The corresponding natural language strings are assumed to have the following characteristics :

(i) Semantically, they can be regarded as wholes, even though they appear graphically as multiple-symbol strings : for instance, 'more + Adjective' as compared to "better".

(ii) No material is insertable between their constituent symbols. Thus, "in order to" is concatenated at this stage, whereas "for the purpose of" is processed in G.2 because some adjectives such as "chief" can be inserted between "the" and "purpose".

(iii) As is perhaps more frequently the case, it is assumed that if insertions are possible, their occurrence could be tested, and the longer string could be processed by means of the same procedure and computer programme, or another such as that of G.2 : for instance, it is assumed that it is possible to add a rule to G.0 if one wishes to allow for the occurrence of "at the least", next to "at least". As already pointed out, G.0 and the following 'grammars' were set up just for the experimental corpus of 50 abstracts, and there is no doubt that various rules would have had to be changed of the experiment had been extended to other texts.

The other main assumptions underlying G.0 (and in fact also the other 'grammars') are the following :

(i) It is assumed that context-free concatenations of immediate constituents are justifiable in a corpus of abstracts like Janaske; for instance, it is assumed that a corpus like Janaske does not present the type of ambiguity occurring in a sentence like "The men who come in order to stop the fighting...", where at least two possible segmentations depend on whether "order" is analyzed as the main verb of the sentence, or whether one reads "in order to" in the relative clause "who...". The assumption proved to be correct in the experimental corpus.

(ii) Should assumption (i) turn out to be incorrect, the approach adopted will have the merit of showing to what extent and in what specific ways assumption (i) is not valid in a corpus of abstracts.

(iii) It is further assumed that unhappy consequences of assumption (i) can be remedied by further rewritings and code manipulations. A possible candidate for performing this task is an error-correcting subroutine or 'grammar'. The existence of such a subroutine has been mentioned in a recent paper (Shapiro 1967).

The types of strings processed by G.O are listed under the headings given below. The treatment of comma and semicolon is scattered under the various headings; I do not know of any satisfactory treatment of this difficult problem in the literature of computational linguistics. Except in a few cases, the concatenations made in G.O are not directly relatable to rules of Harris's string theory. Rather, they serve to rewrite as a single code material which will later be concatenated according to rules partly based on string theory.

(i) Proper nouns.

Various proper nouns are concatenated at this stage because they are equatable with one-symbol expressions : compare, for instance, "United States" and "U.S.". The proper nouns processed by G.O are listed below in (19):

(19)

- Federal+Government; the+(Federal+Government)(J5)
- United+States; the+(United+States)(J6, J30)
- Democratic+Republic; German+(Democratic+Republic); the+(German+Democratic+Republic)(J7)
- the+Americas(J29)
- Near+East; the+(Near+East)(J29)
- Federal+Republic; (Federal+Republic)+of; (Federal+Republic+of)+Germany(J31)
- American+Documentation(J33)
- Soviet+Union(J42, J47)
- Rapid+Selector(J48)

(ii) Anaphoric or cataphoric expressions and pronouns.

The list of the strings brought under this heading is given below in (20). Note the difference in meaning between the occurrences of "the center" in J1 and J7. Also note that, by mistake, various anaphoric expressions have not been processed at this stage : "the classification" (J19) "this system" (J26), "the Institute"(J39), etc. Perhaps the most consistent and systematic treatment of such the+N anaphoric strings would be at the stage of G.2.

(20)

(a) - the+center(J1)
- the+center (J7)
- the+bureau(J48)

(b) - he+feels(J12)
- viewing+it(J12)
- making+it; (making +it)+possible(J19)
- he+explains(J20)
- give+us(J38)
- they+discuss(J38)
- he+believes; (he+believes)+should(J40).

(iii) Genitives.

The genitives processed in G.0 are listed below in (21) :

(21)

- (the+Federal+Government)+'s(J3)
- country+'s(J6)
- machine+'s(J9)
- NPP+'s(J15, J33)
- examiner+'s(J22)
- Hungary+'s(J45)
- (the+bureau)+'s(J48)

(iv) Words associated with Verbs.

The "that" introducing a clause after certain verbs has been concatenated with this verb; "to be","as" following certain verbs or cognate nominals have also been processed in this fashion :

(22)

(a) - concludes+that(J5)
- concluded+that(J11)
- recognizes+that(J12)
- feels+that(J22)
- appears+that(J22)
- indicates+that(J26, J42)
- (stated+emphatically)+that(J47;see below)

(b) - recognized+as(J5)
- (viewing+it)+as(J12)
- (for+use)+as(J36, see below)
- serve+as(J32)

(c) are+:(J38)

(d) to+be(J16, J22, J26, J35, J44)

(v) Wh-words.

Under this heading are grouped various expressions which can be associated with, or rewritten as, relative pronouns :

(23)

- who+is(J8)
- in+which(J9)
- that+which; of+(that+which)(J12)
- of+what(J16)
- in+which(J35)
- in+which; (the+ways)+(in+which); on+(the+ways+in+which)(J40, see below).
- those+who; by+(those+who) (J40)
- ,+which(J46)
- in+which; ,+(in+which)(J48)

(vi) Conjunctions and prepositions.

The list is given below, in (24) :

(24)

(a) - only+,(rewritten as a conjunction:J7)
- so+that(J16)
- as+well;(as+well)+as(rewritten as a conjunction : J26, J46)
- ,+since(J26)
- not+merely;C2+(not+merely)(rewritten as a conjunction : J26; see below)
- ;+and(several occurrences : rewritten as a conjunction)
- ,+and(several occurrences : rewritten as a conjunction , C2 standing for "and")

(b) - in+order;(in+order)+to(J2, J45)
- addition+to; in+(addition+to)(J5)
- with+respect;(with+respect)+to(J11, J16)
- ,+as;(,+as)+far; (,+as+far)+as (J11, see "are concerned", below)
- according+to(J12, J38)
- out+of(J16)
- each+to(J22)
- with+reference; (with+reference)+to(J33)
- as+to(J40)
- such+as; ,+(such+as) (J45, J50)
- as+in (J47)
- because+of(J49)

(c) - into+as; (into+as)+many(J21)
- as+compared(J21)
- by+:(J34)

(vii) Adjectives.

The types of strings concatenated and rewritten as adjectives are given below in (25) :

(25)

(a) - some+of(J6, J49)
- each+of(J7)
- all+of(J1, J19, J21)
- certain+of(J13)
- most+of(J13)
- one+of(J19)
- many+of(J21)
- NUM+of(J24, J25, J32)

(b) such+a (J21, J28, J29)

(c) - large+scale; *no*+(large+scale)(J20)
- long+range(rewritten as adjective : J29)
- high+capacity(rewritten as adjective : J50)

(viii) *Adverbs*.

Various types of adverbs are concatenated with other word-classes. Here, my rules correlate rather closely with some of Harris's rules concerning the *D* (adverbs) category. Thus, Harris treats the type given in (26) (a) as left adjunct of *P* (preposition), the type of *D* given in (26) (b) can be regarded as left adjunct of *A* (adjective), the type given in (c) is analyzed by Harris as right adjunct of *V* (verb), and the type given in (d) is one of Harris's adjuncts of *c* (center string) (Harris 1965, 35-39).

(26)

(a) - particularly+*among*; ,+(particularly+*among*) (J5; rewritten as PAMONG)
- especially+*in*; ,+(especially+*in*)(J38, J46; rewritten as PIN)

(b) - the+most;(the+most)+economic(J11)
- in+as; (in+as)+neat; (in+as+neat)+a (J12)
- the+most; (the+most)+critical(J16)
- more+accurate(J22)
- the+most; (the+most)+important(J25)
- well+ahead(J32)
- manually+operated(J35)
- more+precise(J38)
- more+efficient(J42)
- great+that; so+(great+that)(J43)
- most+frequently(J48)

(c) - change+over(J1)
- carried+out(J2)
- points+out(J9, J38)
- carried+on(J23, J39)

(d) - however+,;,+(however+,)(rewritten as NUL); NUL+that(J12). See above : (he+feels)+that
- addition+,;in+(addition+,);.+(in+addition+ ,)(J18, J22, J29 : the code for In+addition+ comma is amalgamated with that for period, and only the code for period is retained)
- however+,;.+(however+,)(J32 : reduction to the code for period, as above)

(e) at+least(J12)

(ix) Miscellaneous.

Under this heading, I have brought together various concatenations which are mainly intended to bring about preliminary simplifications for later stages in the processing. Some of the concatenations performed at this stage could have been more consistently performed at later stages, as was later realized. One clear example of inconsistency is the concatenation "mass+media"(J41) where "mass" is a left adjunct of "media" which should have been processed in G.2 (see section 2.4.3., below). Another inconsistency is the reduction at this stage (see v, above) of "on the ways in which" (J40) to a single code equivalent to "on how", while a similar string "the way in which" (J35) is only reduced to a single code (XHOW) in G.2

At this stage, I also amalgamated "are" with "concerned" and with a comma following in J11 in order to reduce the string of codes corresponding to "the most economic, as far as x are concerned," to three codes (ignoring x; see above). The NUL code obtained after some of these concatenations of G.0 was deleted by a special subroutine operating immediately after G.0; this subroutine is used again later, after G.1 (see next section) to delete the ADV code for adverbs in cases where it has not been deleted by concatenation rules. The two lists of 'miscellaneous' strings concatenated in G.0 are given below in (27) and (28) :

(27)

- ,+etc.(rewritten as NUL);NUL+,(rewritten as NUL; J25)
- for+use(J26 : see "for+use+as" above)
- the+way(J35)
- ,+etc. (rewritten as NUL; J38)
- in+mind; kept(+in+mind)(J40)
- the+ways(J40)
- per +year(J43)
- of+view; point+(of+view)(J47)

(28)

- NUM+to; (NUM+to)+NUM; from+(NUM+to+NUM)(J13)
- March+NUM(J15)
- NUM+hours(two occurrences : J22)
- quarter+NUM(J33)
- of+between; (of+between)+NUM; (of+between+NUM)+ and (rewritten as POF : J37)
- NUM+seconds(J37)
- NUM+to; (NUM+to)+one (rewritten as NUM : 2 occurrences, J37)
- about+NUM; (about+NUM)+(per+year) (J43; see above)

2.4.2. *G.1*

As already noted, G.1 concatenates pairs of codes between which there is a code for conjunction. Schematically: *AcB*→ *A+B*. Moreover, in enumerations the rewriting~~(s)~~ resulting from (a) preceding concatenation(s) can be concatenated with a conjoined code that follows : *(A+B)cC*→ *A+B+C*. The following (29) is an exhaustive list of the concatenations performed in G.1; they are given in the order of their first occurrence in the experimental corpus. Note that the treatment of conjunction in G.1 differs from that outlined by Harris who proposed to treat, say, *conjunction+B* as right adjunct of *A* (Harris 1965, 39-40). The treatment of *A* and *B* on the same footing (on either sides of the conjunction) which has been adopted here can be preferred on the grounds that : (i) in enumerations it is a bit odd to say that the second and following conjuncts are adjoined (added as something non-essential) to the first; (ii) various conjuncts are reversible without changing the meaning or affecting grammaticality (see, for instance, J25; on this, section 3.1.4).

My treatment of conjunction is a good example of the *superficial* nature of the processing performed by the system presented here. Consider the following sentence : "Lists service bureaus in Canada and the United States by province or state, and by city within province or state" (J30). Under one hypothesis of TG linguistics (see Part III and Stockwell *et al*. 1968), such a sentence would presumably be derived from a deep structure paraphrasable as : "(The author ?) lists service bureaus in Canada by province and he lists service bureaus in Canada by city within province, and he lists service bureaus in the United States by state and he lists service bureaus in the United States by city within state". The sentence as it appears in J30 would be derived by so-called conjunction reduction. In the present system, what can be regarded as already the result of a transformational reduction is further reduced to codes paraphrasable as : lists service bureaus in an international area by region, and by city within region.

(29)

- science+and+technology(J1)
- collecting+,+processing+,+storing+(,+and)+retrieving (rewritten as a code for 'documenting' : J1)
- storage+and+retrieval (rewritten as a code for 'documentation' : J1; J10, 2 occurrences; J11; J13; J15; J50)
- reasoning+and+thinking(J2)
- design+and+construction(J2)
- selection+,+form+,+distribution+,+acceptability (J3)
- medical+and+chemical(J4)
- interpreting+and+determining(J4)
- tracing+and+identifying(J4)
- research+and+development(J5, 2 occurrences)
- scientists+and+engineers(J5)
- scientific+and+technical(J6, 4 occurrences; J29)
- microfilm+and+photocopying(J7)
- problems+and+questions(J11)
- access+,+durability(J11)
- time+,+capacity+(,+and)+efficiency(J11)
- theorems+,+systems(J12)
- revised+and+enlarged(J13)
- research+,+development+(,+and)+testing(J14)
- documentation+and+librarianship(J14)
- individuals+or+organizations(J14)
- retrieval+and+reproduction(J14)
- indexing+,+cataloging+(,+and)+classification(J14)
- production+and+dissemination(J14)
- efficient+and+effective(J16)
- (of+what)+and+how(J16)
- discussion+and+comparison(J16)
- ideas+and+findings(J16)
- adequate+and+efficient(J16)
- methods+,+measures+and+results(J16)
- storage+or+retrieval(J16)
- criteria+and+procedures(J17)
- requirements+,+criteria+(,+and)+measures(J17)
- evaluate+and+compare(J17)
- existing+and+proposed(J17)
- statistical+,+syntactical+and+interrelational(J18)
- concepts+and+interrelationships(J19)

- concepts+and+interrelations(J19)
- (NUM+hours)+or+less(J22)
- input+and+output(J23)
- archives+,+libraries(J25)
- libraries+,+archives(J25)
- German+,+French+,+Italian(J25)
- institutions+,+subjects+(,+and)+personnel(J25)
- code+and+card(J26)
- edge-punched+,+hand-sorted(J26)
- reports+and+memoranda(J28)
- Europe+,+(the+Near+East)+and+Africa(J29)
- Asia+and+Australasia(J29)
- scientific+or+technical(J29)
- Canada+and+(the+United+States)(J30)
- province+or+state(J30 : 2 occurrences)
- Canada+,+France+,+Holland+,+(Federal+Republic+of+Germany)+,+U.S.A.+(,+and)+Italy(J31)
- fast+,+large(J32)
- needs+and+possibilities(J34)
- selection+and+reproduction(J35)
- microfilming+,+punched-cards+(,+and)+xerography (J35)
- manually+or+mechanically(J35)
- filing+and+reproduction(J35)
- recorded+and+filed(J35)
- small+,+(manually+operated)+,+portable(J35)
- design+and+construction(J37)
- display+and+reproduce(J 37)
- NUM+and+NUM(J37)(J43)
- role+and+significance(J38)
- origins+and+development(J38)
- science+and+technical(J38)
- card-indexes+,+libraries(J38)
- source+,+content+and+value(J38)
- graphical+,+pictorial+,+auditory+,+visual(J38)
- collecting+and+investigating(J38)
- sources+and+use(J38)
- Rumanian+,+Hungarian+,+Polish+,+Serbo-croatian+and+Spanish(J38)
- practices+and+attitudes(J40)
- acquisition+and+handling(J41)
- decentralized+and+inefficient(J42)
- means+and+personnel(J42)
- past+,+present+(,+and)+future(J43)
- U.S.+and+U.S.S.R.(J43)
- abstracting+and+indexing(J44)
- librarianship+and+documentation(J45)
- documentation+and+economy(J47)
- professional+and+organizational(J47)

- whole-page+or+total-document(J48)
- lines+and+paragraphs(J48)
- requirements+and+advantages(J49)
- timely+and+accurate(J50)
- illustrations+and+prices(J50)
- manufactured+or+sold(J50)
- obsolete+and+discontinued(J50)
- classified+and+indexed(J50)

In the above examples, I have found only one clear case of unresolvable ambiguity. It is quoted below in (30) (a) as it appears in its context; the bracketings in (b) represent the interpretation I have arbitrarily chosen, and those in (c) represent another possible interpretation. The ambiguity, however, does not affect the indexing by means of the headings of Gardin-Lévy. In (31), I give what I believe to be the only wrong analysis (b) which has crept into the experiment with G.O. The mistake, however, does not affect the indexing either, and what I believe to be the correct analysis (c) could have been obtained by later rules in the system : only "sources and use" should be concatenated at this stage, and the other conjunction reduced in G.6.

(30)

(a) interpreting and determining the content of foreign prescriptions (J4)

(b) (interpreting and determining) the content of foreign prescriptions.

(c) interpreting and (determining the content of) foreign prescriptions.

(31)

(a) collecting and investigating the sources and use of documents (J38)

(b) (collecting and investigating) the (sources and use) of documents.

(c) collecting and (investigating the sources and use of) documents.

Finally, let us note that after G.1 some codes for adverbs are deleted by a special subroutine. Specifically, the subroutine deletes ADV (as for "thereby" in J9, and "at+least" in J12), and ADX not deleted by some earlier rules, as was "only" (J9). However, the semantic codes replacing some adverbs are not deleted : for instance, "logically" (J12), "either (=ADV : deleted) (manually+or+mechanically)" (J35). The adverbs "then" and "very" have (perhaps mistakenly) been given special codes (XTHEN, XVERY), which are not deleted by the subroutine.

2.4.3. G.2

G.2 concatenates in succession strings of six, five, four, three, and two codes into a single code. The strings of six codes had to be processed by a special programme, because the 105 characters necessary for six codes plus a code for the rewriting (15x7) exceeded the 80 characters provided for in the programmes set up for the processing of shorter strings, and available on the punched-cards serving as input. The special programme had been written to process strings of up to 7 codes, but this appeared to be unnecessary, since no rule of that length was needed in the experimental corpus.

There is an obvious reason for beginning by recognizing and reducing the longer strings and for ending with the shorter ones. Thus, the following string of 6 codes given in (32) (a) needs to be processed first, since the other strings given in (32) can be regarded as subsets of (a) :

(32)

(a) 6 codes : of an international technical information system (J29)

(b) 5 codes : - of a technical information system
- of an international information system

(c) 4 codes : - of an information system
- of an international system

(d) 3 codes : of a system.

Grammatically, the strings processed by G.2 fall into the types which are given below. In this section, I shall just list and briefly illustrate the types of strings in question, because a complete list of all the strings processed in G.2 would amount to quoting practically the whole experimental corpus. Besides, such a list is unnecessary since many examples of strings processed in G.2 will have to be given in any case in order to explain the following 'grammars'. Only the examples of six-code strings are listed exhaustively. The concatenation of prepositions with material following has been performed at this stage (cp. Bély *et al*. 1970, 99 : "groupe prépositionnel"). By *Noun* in (ii) are meant not only nouns in the strict sense but also forms that are relatable to verbs but have a grammatical behaviour similar to nouns, in particular as far as their co-occurrence with articles and with prepositions is concerned.

The only grammatically incorrect consequence of the treatment of prepositions adopted concerns what Harris would presumably analyze as *Nof* left adjuncts of Nouns (Harris 1965, 36). In my experiment, the strings of (33) (a) have been segmented as shown in (b), whereas they should have been segmented as in (c) where both the genitives and what is underlined in (a) are analyzed as left adjuncts of N :

(33)

(a) a general review of *the scope of* the Federal Government's role in ... and a review of *the character of* the Federal Government's scientific information activities (J5)
(b) (a general review) (of the scope)(of the Federal Government's role)(in...) and (a review) (of the character)(of the Federal Government's scientific information activities)
(c) (a general review)of((the scope of)(the Federal Government's)role) (in...)and (a review) of ((the character of)(the Federal Government's) scientific information activities).

The only justification for the treatment adopted here (compare "some+of", etc., in G.0) is that, by lumping together graphically similar strings like "*of the* scope" and "*of the* Federal Government's role", one pass in the processing can be saved. Similarly, what Harris treats as 'nominalized' center strings is here broken down into two strings. Thus, about the string "*his description of the experiment*", Harris says in essence that "*description*" is a nominalization of "describe", that "of the experiment" functions as Object, and that the whole string can function as Subject or Object of a center string (Harris 1965, 29-31); here, it would be broken down into "his description" and "of the experiment".

Lastly, note that some concatenations performed in G.0 (ii) such as "he+feels" (J12) could have been more consistently grouped together with some exemplified below in (i) (c), such as "this+reviews" (J2) (see my discussion in Chapter 3.2.).

(i) (a) Auxiliary+Verb and be+x.

Harris (1965, 37 and 32) treats auxiliaries as left adjuncts of V, be as a Verb and various items following be (what is here represented as x) as types of Objects : Also note that I have treated 'constitute' like 'be'.

EXAMPLES

4 codes :
- can+be+a+success(J20)
- is+an+organizing+system(J21)
- will+be+(more+accurate)+than(J22)
- constitutes+a+major+change(J26)
- are+NUM+other+areas(J32)
- being+a+(small+,+manually+operated+,+portable)+unit(J35)
- are+the+retrieval+units(J48)

3 codes :
- must+be+(recognized+as)(J5)
- is+magnetic+tape(J11)
- will+be+lost(J21)
- can+be+punched(J26)
- will+make+possible(J32)
- is+(to+be)+reproduced(J35)
- is+then+printed(J35)
- has+been+designed(J37)
- should+be+replaced(J42)
- constitute+other+centers(J46)
- are+being+intensified(J49)

2 codes :
- was+planning(J1)
- is+variable(J19)
- are+fixed(J19)
- is+developed(J21)
- are+gratifying(J22)
- will+require(J24)
- is+   +beginning(J24 : the blank indicates the position of an adverb deleted after G.1)
- will+(serve+as)(J32)
- will+make(J32)
- is+   +(well+ahead)(J32)
- is+   +suited(J35)
- are+available(J35)
- (are+:)+(graphical+,+pictorial+,+auditory+,+visual)(J38)
- is+(carried+on)(J39)
- would+permit(J42)
- were+NUM(J43)
- is+(so+great+that)(J43)
- continue+unchanged(J43)
-       +being+undertaken(J45)
- is+   +possible(J47)

(b) *wh-word+(a)* (cp. Harris, *loc. cit.* : wh-, etc., are treated as a part of right adjuncts of N; cp. also *whiz* deletion in TG linguistics : for instance, Langendoen 1970)

4 codes :
- which+has+been+*developed*(J5)
- which+may+be+ordered (J12)
- (of+that+which)+may+be+written(J12)
- which+would+be+based(J29)
- which+(he+believes+*should*)+be+(kept+in+mind)(J40)
- which+is+not+reported(J41)

3 codes :
- which+was+*established*(J1)
- that+are+*responsible*(J2)
- that+will+determine(J12)
- which+would+permit(J26)
- (,+which)+is+augmented(J46)

(c) *Cp. (a) and (b)*

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4 codes :
- (who+is)+   +a+*subject+specialist* (J8)
- it+can+be+   +modified(J26)

3 codes :
- it+is+   +*necessary*(J8)
- it+is+(concluded+that)(J11)
- has+broad+applications(J13)
- (to+be)+   +(the+most+critical)+problem(J16)

- it+can+handle(J20)
- it+is+proving(J22)
- there+would+be(J29)
- had+its+origin(J33)
- was+to+present(J34)
- is+(to+be)+reproduced(J35)
- it+is+not(J36)
- is+purported+(to+be)(J44)
- it+is+(stated+that)(J47)
- it+is+(classified+and+indexed)(J50)

2 codes :
- this+reviews(J2 : 'reviews' was coded as a homograph; in the rewriting of G.3, it is represented as a verb)
- which+uses(J9)(J48)
- it+ +possesses(J11)
- this+is(J13)(J18)(J23)(J26)(J44)
- NPP+considers(J16)
- is+that(J19)
- there+are(J21)
- +it+(appears+that)(J22)
- (to+be)+held(J35)
- it+works(J36)
- it+is(J36)
- which+stores(J37)
- one+stores(J37)
- lays+stress(J38)
- there+is(J38)
- (by+those+who)+manage(J40)
- who+observed(J44)

(ii) (a) Left adjunct(s)+Noun (cp. Harris 1965, 36)

Note that the concatenations illustrated below ignore structural differences in the relations between the constituents of the strings : the workings of the computer programme are based only on the number of codes to be recognized as forming a string. Also note the processing of some semi-colons at this stage.

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6 codes(only example) :
(the+bureau+'s)+well-established+NPP+information+retrieval+program(J48)

5 codes :
- this+(country+'s)+(scientific+and+technical)+information+ills(J6)
- the+Automatic+Microfilm+Information+System(J36)
- the+NUM+ +centralized+information+service(J44)

4 codes :
- the+botanical+drug+literature(J4)
- improved+information+(storage+and+retrieval)+systems(J15)
- scientific+information+retrieval+systems(J17)
- (no+large+scale)+information+retrieval+system (J20)
- NUM+established+techniques+:(J35)
- a+very+useful+supplement(J38)
- the+Yugoslav+Bibliographical+Institute (J39)
- the+technical+industrial+libraries (J46)
- (timely+and+accurate)+factual+comparable+data(J50)

3 codes :
- a+general+description(J1)
- the+initial+(reasoning+and+thinking)(J2)
- partial+contents+:(J15)
- (one+of)+its+features(J19)
- the+(examiner+'s)+time(J22)
- a+fast+system(J36)
- its+present+organization(J38)
- other+trade+publications(J41)
- the+ +increasing+need(J42)
- the+same+year(J43)
- the+(Rapid+Selector)+program(J48)

2 codes :
- its+activities(J1)
- user+requirements(J14)
- theoretical+studies(J14)
- documentation+centers(J25)
- user+information(J25)
- (such+as)+those(J28)
- much+work(J32)
- (fast+,+large)+memories(J32)
- the+simplest(J35)
- (the+way)+(in+which)(J35; rewritten as XHOW)
- a+system(J36)
- the+second(J37)
- the+(sources+and+use)(J38)
- science+libraries(J40)
- existing+tools(J43)
- its+core(J45)

(b) Preposition+(s) (see also examples with semi-colon). This includes simple PN adjuncts of center strings (Harris 1965, 39) such as "in the second chapter" (J38).

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6 codes (exhaustive list)

- in+the+following+NUM+areas+:(J14)
- to+some+other+search+file+system(J21)
- of+an+international+technical+information+system(J29)
- (with+reference+to)+(NPP+'s)+NUM+basic+building+rules(J33)
- of+the+Automatic+Microfilm+Information+System(J36)
- on+a+cathode+ray+tube+screen(J37)
- of+the+centralized+science+information+services(J44)

5 codes :

- to+a+mechanized+(storage+and+retrieval)+system(J1)
- of+NPP+scientific+translation+program (J3)
- into+the+following+parts+:(J6)
- from+(certain+of)+their+basic+characteristics(J12)
- of+scientific+information+retrieval+systems(J17)
- of+the+NUM+element+,(J24)
- to+(NUM+of)+(the+most+important)+Swiss+(libraries+,+archi~~v~~ves)(J25)
- in+the+pertinent+geographical+region(J25)
- (for+use+as)+a+detailed+search+code(J26)
- of+a+new+subject+index(J27)
- in+a+standard+eighty-column+punched-card(J35)
- in+the+traditional+(mass+media)+effort (J41)
- of+the+large+production+centers(J46)
- for+all+known+microreproduction+equipment (J50)

4 codes :

- in+the+(medical+and+chemical) literature (J4)
- at+(NPP+'s)+NUM+NPP(J15)
- ihto+NUM+classes+:(J16)
- in+this+system+,(J19)
- between+the+(input+and+output)+languages(J23)
- :+a+pragmatic+approach(J27)
- of+the+various+types(J27)
- :+one+for+(the+Americas)(J29)

- by+NUM+appendices+:(J33)
- over+a+special+aperture(J35)
- having+linear+reduction+ratios(J37)
- in+the+NUM+chapter(J38)
- by+NUM+divisions+:(J39)
- (as+to)+certain+general+(practices+and+attitudes)(J40)
- for+a+(more+efficient)+organization(J41)
- of+scientific-technical+information+centers(J46)
- from+the+(professional+and+organizational)+(point+of+view)(J47)
- whatever+the+financial+cost(J47)
- by+the+proposed+NPP(J47)
- on+a+(whole-page+or+total-document)+basis(J48)
- to+many+new+areas(J50)

3 codes :

- for+the+purpose(J1)
- for+the+dissemination(J2)
- of+the+scope(J5)(J42)
- (in+as+neat+a)+fashion+as(J12)
- (with+respect+to)+the+latter(J16 : rewritten as NUL, and deleted after G.2)
- as+a+basis(J20)
- (into+as+many)+sections+as(J21)

- in+the+past(J27)
- :+(long+range)+planning(J29)
- off+the+reel(J35)
- before+being+installed(J37)
- on+the+(role+and+significance)(J38)
- PIN+(science+and+technical)+subjects(J38)
- (according+to)+the+(sources+,+content+and+value)(J38)
- of+the+Institute(J39)
- :+a+survey(J40)
- in+NUM+journals (J43 : wrong analysis)
- in+the+world(J44)
- of+(Hungary+'s)+network(J45)
- of+scientific-technical+information(J46)
- by+a+NPP (J46)
- by+ +qualified+personnel(J47)
- on+old+ones(J49)
- (because+of)+their+applications(J49)
- (such+as)+(high+capacity)+(storage+and+retrieval)(J50)

2 codes :
- of+NPP(J1)
- (in+order+to)+achieve(J2)
- of+(selection+,+form+,+distribution+, +acceptability)(J3)
- (as+far+as)+costs(J11)
- as+ +appropriate(J12 : this 'as' should have been concatenated like others in G.O)
- ,+NUM(=,1957-1958 : J14)
- :+(statistical+,+syntactical+and+interrelational)(J18)
- in+that(J22)
- (to+be)+possible(J22)
- to+ +handle(J22)
- (each+to)+(NUM+hours+or+less)(J22)
- :+(German+,+French+,+Italian)(J25)
- (to+be)+used(J26)
- a+minute(J35)
- in+Rumania(J38)
- in+NUM(J38)
- :+(past+,+present+,+and+future)(J43)
- for+developing(J43)
- (,+such+as)+decentralization(J45)
- (in+order+to)+build(J45)
- PIN+Czechoslovakia(J46)
- (as+in)+(the+Soviet+Union)(J47)
- nor(=XNOR)+desirable(J47)

2.4.4. G.3

Like G.1, G.3 concatenates conjoined strings, and it uses the same computer programmes as G.1. Since the strings processed at this stage are by far fewer in number than those processed in G.2, I shall give a complete list of these conjoined strings below in (34). As will be noted, many concatenations performed at this stage operate on the results of concatenations performed in G.2 : for instance "its+activities"(J1).

When some point deserves to be made about the rewriting, the quotation is followed by a paraphrase of, and a comment on, this rewriting. The paraphrase is given between single quotation marks ('——'). No current theory, as far as I can see, is able to provide a basis for my rewritings. My paraphrases and my comments must therefore be regarded as statements of semantic problems raised by my experiment. Many of these problems have to do with what I have referred to earlier as the inference-making process involved in indexing, and in the resulting loss of information. Because of these problems, I shall henceforth give up the convention which consisted of underlining the string whose information is preserved in the rewriting.

G.3 processes strings of the following types :

(i) Conjoined nouns with or without left adjuncts : for instance, "NPP+and+(its+activities)"(J1)

(ii) Conjoined strings consisting of Preposition+left adjunct(s)+Noun preceding, and left adjunct(s)+Noun following the conjunction; these strings are transformationally relatable to type (iii) : for instance, "(in+EDP)+and+(information+systems)"(J15).

(iii) Conjunctions of Preposition+left adjunct(s)+Noun : "of drawing-office supplies and of reproduction drawings" (J35).

(iv) Conjunctions of verbs.

(v) Strings relatable to the former by virtue of preceding concatenations.

(vi) Various strings separated by a comma : see J26.

(34)

- NPP+and+(its+activities)(J1); rewritten as a code paraphrasable as noun singular, definite, institution; I have assumed that "its activities" imposes this interpretation on the NPP that precedes.
- (of+selection+,+form+,+distribution+,+acceptability)+(,+and)+(translation+rights)(J2); rewritten as a code paraphrasable as 'of the development of translations'; the discussion on asymmetric conjunction in Part III is devoted to what happens in this type of conjunction.
- (the+Federal+Government)+and+(U.S.+scientific+information)(J5); rewritten as the code already obtained for the second conjunct, namely 'national documentation', which corresponds to heading 5 of the Gardin-Lévy concordance (see Appendices 1 and 2).
- (of+microfilm+and+photocopying+services)+or+(photocopying+service)(J7); rewritten as 'of photocopying services'.
- (of+a+scientific+information+officer)+and+(a+librarian)(J8); rewritten as 'of a documentalist'.
- (among+magnetic+drums)+,+(magnetic+tape)+,+(magnetic+wire)+,+(ferromagnetic+cores)+,+punched-cards+,+(punched+tapes)+(,+and)+(photographic+tapes)(J11); rewritten as 'among, plural, storage equipment'.
- (with+respect+to+their+access+,+durability)+,+(storage+and+retrieval+time)+,+(capacity+,+and+efficiency)(J11); rewritten as 'with respect to qualities'.
- (in+EDP)+and+(information+systems)(J15); rewritten as 'in data processing and documentation systems'.

- (in+information+retrieval)+and+(data+acquisition) (J15); rewritten as 'in documentation'.
- (of+information+retrieval+systems)+;+(improved+information+storage+and+retrieval+systems)(J15); rewritten as 'of documentation systems'.
- (are+many)+,+(including)(J21); rewritten as 'include'.
- (steroid+compounds)+and+NPP(J22); rewritten as 'topics in a particular discipline', on the basis of "steroid compounds"; here, NPP is actually given a wrong interpretation; the text reads 'ILAS' which stands for "Interrelated Logic Accumulating Scanner", a "punched-card machine" mentioned in J322.
- (archives+,+libraries)+and+(documentation+centers)(J25); rewritten as 'documentation institutions'.
- (to+NUM+of+the+most+important+Swiss+libraries+,+archives)+,+(documentation+centers)(J25); rewritten as 'to national documentation institutions', a rewriting already chosen for the first conjunct in G.2.
- (historical+development)+,+holdings+,+(special+collections)(J25); rewritten as 'history and holdings'.
- (all+functional+units)+(,+and+not+merely)+(the+filing+categories)+,+(can+be+punched)(J26); rewritten as 'units and classification entries can be punched'; I have found no better way of treating the comma preceding the verb; I have not been able to figure out what is meant by "functional units".
- (a+search+code)+(as+well+as)+(a+filing+order+code)(J26); rewritten as 'search and storage code'.
- (one+for+the+Americas)+;+(one+for+Europe+,+the+Near+East+and+Africa)+;+(one+for+Asia+and+Australasia)(J29); rewritten as 'for name of international area'.
- (by+province+or+state)+(,+and)+(by+city)(J30); rewritten as 'by geographical region'.

- (of+drawing-office+supplies)+and+(of+reproduction+drawings)(J35); rewritten as 'of equipment and reproductions'.
- (NUM+chapters)+and+(a+subject+index)(J38); rewritten as 'parts of document'.
- abroad+and+(in+Rumania)(J38); rewritten as 'in an international area'.
- (research+work)+and+planning(J38); rewritten as 'research'.
- (house+organs)+and+(trade+publications)(J41); rewritten as 'special documents'.
- (of+house+organs)+and+(other+trade+publications)(J41); rewritten as 'of special documents'.
- history+and+(further+development)(J46); rewritten as 'history'.
- NPP+and+(the+documentation+branches)(J46); rewritten as 'the parts of documentation institutions'.
- (of+the+research+institutes)+or+(of+the+large+production+centers)(J46); rewritten as 'of the institutions'.

2.4.5. G.4

G.4 uses the same computer programmes as G.0. It concatenates only two codes at a time, but it can concatenate a code obtained by one rewriting with a code following, and it can also operate in several passes : see the examples of J18, J19 and J22 given below in (35). Since the strings processed in G.4 are relatively few in number, I give a complete list of these strings below in (35). G.4 concatenates the following types of strings :

(i) Nouns which can be partly analyzed as left adjuncts of Nouns, together with what has been concatenated with these left adjuncts (including prepositions) in G.2, are concatenated with the Noun they are adjoined to and what has been concatenated with this Noun. Consider, for example, the string "of the character of the Federal Government's scientific information activities" (J5). I assume that according to Harris's string theory, this string would be represented by a string formula paraphrasable as "P(preposition of)+left adjuncts ofN+N (=activities)" (Harris 1965, 36 on left adjuncts of N : "group effort", "wild plan", "a sort of investigator"). As pointed out in section 2.4.3., however, the segmentation on which G.2 is based is somewhat different, and can be represented as "of the character" and "of the Federal Government's scientific information activities", respectively. G.4, then, concatenates the codes for these two types of strings : (of the character)+(of the Federal Government's scientific information activities). In the rewriting, the information corresponding to what Harris would analyze as an Nof left adjunct of N ("a sort of investigator", "the character of...activities") is done away with. When this Nof adjunct is preceded by a preposition ("of the character") this preposition is preserved in the rewriting : thus, the rewriting assigned to the above example from J5 is paraphrasable as '*of* national governmental documentation'. It is the omissibility of "*the character of*" which served me as a basis for deciding that a given Noun can be analyzed as left adjunct of a Noun. Thus, Harris would say that the excision of "*a sort of*" preserves sentencehood in "He is a sort of investigator" (Harris, *loc. cit.*). Similarly, the excision of "*the character of*" in "a review of *the character of* the Federal Government's scientific information activities" (J5) results in a grammatical string (Note, however, that the excision of "investigator" in Harris's example, and of "*activities*" in the extract from J5 have different effects; some of the special properties of the words "information" and "activities" in the above example will be discussed in Part III).

(ii) The theoretical status of the second type of string processed at this stage is unclear in string theory and is disputed in other theories, as far as I can see. An example is "*for the purpose* of" (J1). In G.4, a string such as "for the purpose" is concatenated with the "of Ving" that follows : (for the purpose)+(of contributing)(J1). The rewriting is paraphrasable as "*for* contributing". My justification for this type of concatenation lies precisely in this paraphrasability, and in the analogy between what happens here and what happens when an *Nof* adjunct of *N* is left out.

(iii) Like that just mentioned, the third type of concatenation performed in G.4 is based on a paraphrase relation, since its theoretical status is unclear or disputed. For example, "*presents*" is concatenated with the following "*a review*" (J5) and the rewriting is paraphrasable as "verb, *reviews*".

(iv) Some special cases : see examples below in J6, J7, J8, J19, and similar examples in other abstracts. These include the rewriting of "articulate" sentences ("I thank you") as "semi-articulate" ("Thank you!") or "inarticulate" sentences ("Thanks!") (Jespersen 1965, 308; see Chapter 3.2). Also note the treatment of codes corresponding to strings with semi-colon, as in J6. An example of a drastic simplification without grammatical motivation is the deletion by rewriting of the codes for "One of its features is that" in J19. Compare the treatment of "The results are gratifying in that" (J22).

Like in the preceding section, the paraphrases of the rewritings given below in (35) after the examples are intended to point to various problems which I have experienced in setting up the codes for my experiment, particularly in connection with the loss of information which 'takes place' during the process of indexing.

(35)

- (for+the+purpose)+(of+contributing)(J1); rewritten as 'for contributing'; more precisely, "for the purpose of" was rewritten as a code standing for 'Preposition of purpose'.
- (in+order+to+achieve)+(a+net+improvement)(J2); rewritten as 'for improving'; more precisely, the code for the rewriting adopted in the experiment is paraphrasable as 'Preposition of purpose, Verb with some qualitative sense'; this loss of information corresponds to the fact that the specific meaning of 'for improving' need not be retained to index the abstract in which the string in question occurs. Note a similar loss of information in connection with "net".
- (in+addition+to+presenting)+(a+general+review) (J5); rewritten as 'in addition to reviewing'.
- (of+the+scope)+(of+the+Federal+Government+'s+role)(J5); rewritten as 'of governmental role'.

- (of+the+character)+(of+the+Federal+Government+'s+scientific+information+activities)(J5); rewritten as 'of national governmental documentation'.
- presents+(a+review)(J5); rewritten as 'Verb, reviews'.
- (an+integral+part)+(of+research+and+development)(J5); rewritten as 'research'.
- (into+the+following+parts+:)+(the+present+situation)(J6); rewritten as 'into the situation'.
- (the+address)+(is+given)(J7); rewritten as 'Gives the address' (see 3.2 on the relations between passive and semi-articulate sentences).
- (additional+information)+concerns (J7); rewritten as 'verb, studies (or : discusses)' (see 3.2.).
- coverage+provided (J7); rewritten as 'coverage'.
- (a+syllabus)+(is+presented)(J8); rewritten as 'presents a syllabus'; compare "the address is given" in J7.
- (for+a+student)+(who+is+a+subject+specialist)(J8); rewritten as 'for a student'.
- (a+comparison)+(is+made)(J11); rewritten as 'a comparison'; this rewriting has the effect of converting an articulate sentence into a semi-articulate one (see 3.2.).
- (NUM+suggestions)+(are+advanced)(J11); rewritten as 'suggestions' (Cp. preceding example).
- (of+the+entire+body)+(of+written+knowledge)(J12) rewritten as 'of information'.
- (a+finite+series)+(of+conjoined+propositions)(J12); rewritten as 'topics of a science related to documentation' (Group 4 of Gardin-Lévy : see Appendix 1).
- (binary-octal+designations)+(are+established)(J12); rewritten as 'Develops codes' (see 3.2.).
- (from+the+field)+(of+logic) (J12); rewritten as 'from a science related to documentation' (see "conjoined propositions" in J12 above).
- (substantial+proportion)+(of+that+which+may+be+written) (J12); rewritten as 'what may be written'.
- (this+is)+(a+revised+and+enlarged+edition)(J13); rewritten as 'edition' (see 3.2. on inarticulate sentences).

- (most+of+the+material)+(has+broad+applications) (J13); rewritten as 'can be used', a rewriting already assigned to "has broad applications" in G.2.
- (in+the+following+NUM+areas+:)+coding (J14); rewritten as 'in coding'.
- (partial+contents+:)+advances (J15); rewritten as 'includes advances'.
- (over+a+span)+(of+NUM+years) (J16); rewritten as 'over years'.
- (into+NUM+classes+:)+need (J16); rewritten as 'into need'.
- advantages+(of+the+new+techniques)(J16); rewritten as 'the techniques', a rewriting already assigned to "(of) the new techniques" in G.2.
- recommendations+(were+made) (J17); rewritten as 'recommendations'.
- (this+is)+(a+description)(J18); rewritten as 'a study' (see 3.2.).
- (of+the+following+types)+(of+information+retrieval+systems)(J18); rewritten as 'of documentation systems+colon' ; this rewriting in turn is concatenated with the following code for (:+statistical+,+syntactical+and+interrelational),and the rewriting of the pair is paraphrasable as 'of documentary languages'.
- (NUM+types)+(of+punched-cards)(J19); rewritten as 'punched-cards'.
- (one+of+its+features)+(is+that)(J19); the rewriting obtained is itself concatenated with a code for period that precedes, which is preserved as the final rewriting; in other words, the string 'period+one of its features is that' is reduced to the code for period. Compare the deletion of the code for various adverbs : a discourse connective like "In particular" would also have been deleted if it had occurred instead of "One of its features is that".
- (it+can+handle)+searching(J20); rewritten as 'it can search'.
- (there+are)+(different+codes)(J21); rewritten as 'Noun, codes'.
- (the+advantages)+(of+this+inverted+search+file) (J21); rewritten as 'inverted file'.

- (a+systematic+procedure)+(is+developed)(J21); rewritten as 'develops procedure'.
- (the+results)+(are gratifying)(J22); the rewriting of the two codes is itself concatenated with the code for the following (in+that); the second rewriting is then concatenated with the code for a period that precedes, which is preserved as the final rewriting; these successive rewritings, then, have the effect of replacing the codes for ".The results are gratifying in that" by the code for period.
- (from+an+average)+(of+NUM+hours)(J22); rewritten as 'from hours'.
- (this+is)+(an+explanation)(J23); rewritten as 'a study'.
- (one+basic+part)+(of+their+program)(J23); rewritten as 'their program'.
- work+(is+ +beginning)(J24); rewritten as 'work'.
- (of+the+NUM+element+,)+(machine+languages)(J24); rewritten as 'of machine languages'.
- (descriptive+data)+include (J25); rewritten as 'Verb, studies'.
- (this+is)+(a+modification)(J26); rewritten as 'a modification'.
- (information+retrieval)+(:+a+pragmatic+approach) (J27); rewritten as 'a documentation method'.
- includes+(a+short+account)(J27); rewritten as 'Verb+study'.
- (of+the+various+types)+(of+subject+indexes)(J27); rewritten as 'of documentary languages', a rewriting already assigned to "of subject indexes" in G.2.
- includes+discussion(J29); rewritten as 'verb+ study'.
- including+description (J31); rewritten as 'Ving+ study'.
- provide+(automatic+reference)(J32); rewritten as 'Verb+mechanical documentation'.
- (higher+densities)+(of+storage)(J32); rewritten as 'storage'.
- (to+the+deluge)+(of+technical+literature)(J32); rewritten as 'to the literature'.

- (of+the+principal+features)+(of+the+classification)(J33); rewritten as 'of the documentary language'.
- (by+NUM+appendices+:)+(classified+guide)(J33); rewritten as 'by a guide'.
- (by+:)+NPP(J34); rewritten as 'by NPP'.
- (NUM+established+techniques+:)+(microfilming+, +punched-cards+,+and+xerography)(J35); rewritten as 'microfilming+punched-cards+xerography'.
- (at+a+speed)+(of+NUM+feet)(J35); rewritten as 'at quantitative information', a rewriting already assigned to '(of) NUM feet' in G.2.
- (in+a+space)+(of+NUM+square+feet)(J35); rewritten as 'in quantitative information', a rewriting already assigned to '(of) NUM square feet' in G.2.
- details+(are+given)(J35); rewritten as 'study'.
- (with+figures)+(of+savings)(J35); rewritten as 'with quantitative information', a rewriting already assigned to '(of) savings' in G.2.
- (it+is)+(a+fast+system)(J36); rewritten as 'a system'.
- (it+is+not)+(a+system)(J36); rewritten as 'not a system'.
- (of+elements)+(of+a+mechanized+library+system) (J37); rewritten as 'of a mechanized documentation system'.
- (on+feasibility+models)+(of+a+memory)(J37); rewritten as 'on future storage equipment'.
- (in+the+form)+(of+microphotographs)(J37); rewritten as 'as microphotographs'.
- (are+undergoing)+(final+tests)(J37); rewritten as 'are being tested'.
- (an+attempt)+(is+made)(J38); rewritten as 'an attempt'.
- (the+different+types)+(of+documentation)(J38); rewritten as 'documentation, comparison'; this rewriting is concatenated with the code for (points+out) that precedes, and the pair of codes is rewritten as 'compares+documentation'.
- (there+is)+(a+very+useful+supplement)(J38); rewritten as 'a supplement'.

- (by+NUM+divisions+:)+NPP(J39); rewritten as 'by NPP'.
- (scientific+literature+use)+(:+a+survey)(J40); rewritten as 'literature use study'.
- (for+the+expansion)+(of+medical+information) (J42); rewritten as 'for documentation in a particular discipline'.
- (through+improvement)+(in+methods)(J42); rewritten as 'through methods'.
- (of+the+scope)+(of+medical+documentation)(J42); rewritten as 'of documentation in a particular discipline'.
- growth+(of+chemical+literature)(J43); rewritten as 'literature in a particular discipline'; this rewriting is concatenated with the code for (:+past+,+present+,+and+future)that follows, and is preserved as the final rewriting.
- support+(is+needed)(J43); rewritten as 'Verb, need+support'.
- (this+is)+(a+report)(J44); rewritten as 'a study'.
- (an+account)+(is+given)(J45); rewritten as 'a study', the rewriting already assigned to 'an account' in G.2.
- (greater+variety)+(in+collections)(J45); rewritten as 'collections'.
- (is+ +possible)+(nor+desirable)(J47); rewritten as 'verb, negation, possible+desirable'; this string could have been more consistently processed as a conjunction, but this was not possible because the dictionary code which was assigned to 'nor' (XNOR) does not represent this word as a conjunction (C).
- (countless+efforts)+(have+been+made)(J49); rewritten as 'efforts'.
- (some+of+the+requirements+and+advantages)+(of+classification+systems)(J49); rewritten as 'documentary languages'.
- (to+many+new+areas)+(such+as+high+capacity+storage+and+retrieval+and+data+management)(J50); rewritten as 'to documentation+related science', a rewriting already assigned to "(such as) high capacity storage and retrieval and data management" in G.2.

2.4.6. G.5

G.5 uses the same computer programmes as G.2. It concatenates in succession strings of six, five, four, three, and two codes and rewrites them as a single code. Like in the presentation of G.2, I shall just give a few examples of the rules of G.5, because a complete list would amount to quoting practically the whole of the experimental corpus. Only the strings of 6 codes will all be quoted below : in total, 8 examples. Some of the examples not given in this section will be presented in later sections to explain the workings of other 'grammars'.

I shall present the examples by quoting first the object-language string, then the paraphrase of the corresponding codes, and lastly the paraphrase of the rewriting of the codes as a single code. Here again, I wish to stress the fact that the paraphrases of the codes are presented as problems generated by my experiment.

One general point which needs to be made about G.5 is the following. Whenever a conjunction or a comma stands in the way of a concatenation which could be performed in G.5, this concatenation is not performed and is left over to a later 'grammar' (G.7) operating after the necessary 'conjunction' reduction (in G.6). This is best explained by means of a few examples. Consider the following quotation from J12 : "binary-octal designations are established for theorems, systems of logic and for statements in propositional calculus". Before the operation of G.5, this string is concatenated as follows: (binary-octal+designations+are+established)(for+theorems+, +systems)+(of+logic)and(for+statements)+(in+propositional+ calculus). The "and" stops the concatenation in G.5, which merges together the codes as shown by the following bracketings : (binary-octal+designations+are+established+for +theorems+,+systems+of+logic)and(for+statements+in+propositional+ calculus). The string "for statements in propositional calculus" is conjoined with what precedes in G.6. Similarly, in J32, the processing of a when-clause is delayed until G7 because of the occurrence of a conjunction : "when the problems of input and of the automatic generation of classification information are solved". A comma also stops the processing of "(the author) draws, from reports by NPP on..." (J40) in G.5. With the qualification just made, the strings processed in G.5 fall under the grammatical types listed below in (i) to (iv).

I must also point out that some inconsistencies have crept into the experiment. One of these may be mentioned here; it concerns the treatment of subordinate and relative clauses. Some of these are treated as illustrated under heading (iii). Others are treated as right adjuncts of nouns : for instance, the 6-code example of J9 given below under heading (i). On the basis of the experience gained during the experiment, I am unable to say which of these two solutions is to be preferred.

(i) Verbs, adjectives, cognate nominals and nouns+strings following.

The strings brought under this heading are partly equivalent to Harris's "object of the verb" category (written as omega : Harris 1965, 30-33), and partly to his PN (preposition+noun) right adjuncts of N (op.cit., 37). Thus, for Harris "his description of the experiment" is the Object of "reviewed" and "of the experiment" the Object of "description" in "I reviewed his description of the experiment" (Harris, loc. cit.), and what is underlined in

Harris's example (i.e. everything except the subject) would be concatenated in G.5. The right adjunct "in the painting" in "the colors in the painting" would also be concatenated with the preceding string "the colors" at this stage (Harris, loc. cit.). The strings following verbs and cognate nominals, however, may also consist of what Harris would presumably analyze as subjects : for instance, a by-phrase after a verb or a noun.

This is the place to mention a difficulty which I have experienced with strings consisting of Noun+PN right adjunct, which are processed at this stage. The difficulty can be explained in Stockwell et al.'s terms. It has to do with a distinction made by Chomsky 196[illegible] between an NP+Prep+N construction, "such as a house in the woods", and "a reduced relative, such as that book on the table" (Stockwell et al. 1968, 489). I have attempted to incorporate this distinction into the order of processing in the experiment. Thus, the concatenation of "problem" or "problems" with "in communicating Russian science" (J3) and with "of preparing an inverted file" (J21) has been delayed until G.7, because parallel expressions such as "problems confronted in..." (J21) and "problems which would be encountered in..." (J29) are processed in G.7. Compare the treatment of the string "(the annotations) are written in the language used in the pertinent geographical region :..." (J25) : the concatenations (are+written+in+the+language)and(used +in+the+pertinent+geographical+region+:...) are performed in G.5 and the resulting codes. (written in the language) and (of the region) are later concatenated in G.7. Occasionally, however, I have failed to make the appropriate decisions in this respect, for lack of reliable detailed knowledge about the lexical items and the transformations involved. For instance, "alphabetical indexes" has been concatenated in G.5 with the following "of institutions, subjects, and personnel" (J25). This may be a mistake, since paraphrases such as "indexes giving/that give..." are possible. Moreover, the concatenation in G.5 of "some problems and questions" with "of patent documentation in industry" (J11) is not consistent with the treatment of the strings with "problem" just quoted. The same is true of the concatenations (three representative problems)+(of a manufacturer of fine chemicals)(J4) and "(should attend)+(to the problem)+(of encyclopedic organization)+(of their knowledge)"(J16) in G.5.

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6 codes :

- contains+(all+of+the+document+codes)+(for+all+of+the+documents)+(in+which)+(the+term)+appears (J9); contains+(document codes)+(for documents)+(in which)+(the term)+appears; 'contains documents codes'.
- (making+it+possible)+(to+search)+(for+all+of+the+information)+(in+the+file)+(of+interest)+(to+the+searcher)(J19); (making possible)+(to search)+(for the information)+(in the store)+(of interest)+(to the searcher); 'making possible to search'.
- representing+(all+of+the+subunits)+(of+information)+(in+all+of+the+documents)+(in+the+memory)+(of+the+machine)(J21); representing+(the units)+(of information)+(in the documents)+(in the store)+(of the machine); 'for the stored information units'.

- (will+make+possible)+(low-cost+memories) (of+billions+of+words)+(with+access)+ (to+any+part)+(in+a+few+seconds)(J32); (will make possible)+(stores+quantitative, economic specifications)+(with possible use)+(to a part)+(in time units); 'will make searching possible'.

- (a+description)+(of+Hungary+'s+network)+ (of+technical+libraries)+(with+NPP)+ as+(its+core)(J45);(a study)+(of national organization)+(of documentary institutions)+(with NPP)+as+(its core); 'a study of national documentation'.

5 codes : - Lists+(service+bureaus)+(in+Canada+and+ the+United+States)+(by+province+or+ state+,+and+by+city)+(within+province+ or+state)(J30); lists+institutions+ (in international area)+(by region); 'verb, lists international institutions'.

4 codes : - report+(on+a+study)+(of+scientific+ communications)+(for+NPP)(J2); report +(on a study)+(of documentation)+(for NPP); 'study of a study of documentation for NPP'.

- (this+reviews)+(the+initial+reasoning+ and+thinking)+(behind+the+design+and+ construction)+(of+a+project)(J2); studies+(the thinking)+(behind the development)+(of a project); 'studies the thinking behind the development of a project'.

3 codes : - (was+planning)+(to+change+over)+ (to+a+mechanized+storage+and+retrieval+ system)(J1); (planned)+(to change over)+ (to a mechanized documentation system); 'planned to use a mechanical system'.

- (NUM+representative+problems)+(of+a+ manufacturer)+(of+fine+chemicals)(J4); problems+(of a scientist)+(of topic of a science);'problems of a scientist'.

- (house+organs+and+trade+publications) +as+(information+sources)(J41); (special documents)+as+(information sources); 'special document sources'. Note the treatment of 'as' at this late stage, because of its possible status as subordinate conjunction, and because it could not safely be concatenated with what precedes until G.5.

2 codes : - (a+general+description)+(of+NPP)(J1); (a study)+(of NPP); 'a study of NPP'.

- similar+(to+that)(J1); similar+(to that); 'similar to that'.
- used+(by+NPP)(J1); used+(by NPP); 'used by NPP'.
- available+(from+the+center)(J1); available+(from the center); 'available from the center'.
- (the+charges)+(for+each)(J1); (the charges)+(for each); 'the charges for each'.
- (tracing+and+identifying)+(NPP references)(J4); finding+documents; 'documenting special documents'.
- (the+dissemination)+(of+scientific+information)(J5); (the dissemination)+(of information); 'documentation'.

(ii) Preposition+'Verb'+'Object'.

'Object' may include a relative clause (see iii), as in the first example given below. 'Verb' includes cognate nouns.

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6 codes : - (from+reports)+(by+NPP)+(PON/HOW)+(scientific+personnel)+gather+information(J40); (from studies)+(by NPP)+(on how)+scientists+gather+information; 'from study of user'.

5 codes : - (to+develop)+(automatic+classifications)+(of+chemical+concepts+and+interrelations)+(in+the+disclosures)+(of+the+patent+literature)(J19); (to develop)+(mechanical classifications)+(of information in a particular discipline)+(in documents)+(of type of literature); 'to develop mechanically documentary language in a particular discipline'.

4 codes : - (for+improving)+(the+dissemination)+(of+scientific+information)+(PAMONG+U.S.+scientists+and+engineers)(J5); (for Verb,Qualitative)+(the dissemination)+(of information)+(among national scientists); 'for national documentation'.

3 codes : - (to+affect)+(the+behavior)+(of+scientific+institutions)(J2); (to affect)+(the behavior)+(of institutions); 'to affect institutions'.

- (with+a+discussion)+(of+the+problems)+(of+selection+,+form+,+distribution+,+acceptability+,+and+translation+rights)(J3);(with a study)+(of the problems)+(of the development of translations);'with a study of the development of translations'.

- (in+searching)+(for+information)+(in+the+medical+and+chemical+literature)(J4); (in searching)+(for information)+(in the literature of a particular discipline); 'in documenting in a particular discipline'.

- (in+addition+to+presenting+a+general+review)+(of+the+scope+of+the+Federal+Government+'s+role)+(in+research+and+development)(J5);(in addition to a study)+(of governmental role)+(in science); 'in addition to a study of governmental role in science'.

2 codes : - (to+determine)+ways(J2); (to determine) +ways; 'to develop ways'.

- (in+communicating)+(Russian+science) (J3); (in communicating)+(national science); 'in documenting national information'.

(iii) Subordinate and relative clauses not processed in preceding 'grammars', and the pronoun the relative clauses are adjoined to, if any.

This includes SOME expressions of the type given in (ii). In the experiment, there have been some inconsistencies and hesitations about these expressions, particularly expressions of purpose. Compare, for instance, the examples of J1 and J5 given below; in the example of J1 (6 codes) an expression of purpose ("for the purpose of...") is concatenated with what precedes ("...established"); in the example of J5 (2 codes), an expression of purpose ("for improving...") has not been concatenated with what precedes ("which has been developed by NFP"). There have been similar hesitations with for-to expressions, as in "necessary for the machine to search the pertinent terms in the machine's memory" (J9). In the experiment, I have adopted the transformationally wrong segmentation (necessary for the machine) (to search...). I also wish to point out that that-clauses after verbs like "conclude" have not been concatenated at this stage with the preceding verb. Lastly, note that what Harris analyzes as PN adjuncts of center strings (e.g. 'at this time': Harris 1965, 39), is processed at this stage : in fact, the example given below from J1 ("at the time of this report") is paraphrasable as a subordinate clause : "(at the time)(when)this report was written".

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6 codes : - (which+was+established)+(for+the+purpose+of+contributing)+(to+the+development)+(of+science+and+technology)+(by+collecting+,+processing+,+storing+,+and+retrieving)+(scientific+information)(J1); (which was established)+(for contributing)+(to the development)+(of science)+(by documenting); 'which documents'.

- The following example constitutes an inconsistency in the experiment. Other concatenations of relative clauses with what precedes have been performed in G.7 : (the+bureau+'s+well-established+NPP+information+retrieval+program)+(,+in+which)+(the+individual+lines+and+paragraphs)+(are+the+retrieval+units)+employed(J48); (the institution's retrieval program)+(in which)+(the text parts)+(are documentation units)+used; 'institutional retrieval program'.

5 codes : - (that+are+responsible)+(for+the+dissemination)+(of+recorded+information)+(in+order+to+achieve+a+net+improvement)+(in+scientific+productivity)(J2); (that are responsible)+(for the dissemination)+(of information)+(to verb, qualitative)+(in science); 'which document'.

- (so+that)+(advantages+of+the+new+techniques)+(for+automatic+storage+or+retrieval)+(of+information)+(may+be+exploited)(J16); (so that)+(the methods)+(for mechanized documentation)+(of information)+(may be used); 'to use mechanized documentation methods'.

- so+(the+information)+(is+divided)+(into+as+many+sections+as)+(there+are+different+codes)(J21); so+(the information)+(is divided)+(into as many parts as)+(codes); 'so that the information quantitatively compared to codes'.

4 codes : - unless+(a+systematic+procedure)+(is+developed)+(for+preparing)+(the+file)(J21); unless+(a method)+(is developed)+(for+developing)+(the store); 'unless a method is developed for developing the store'.

3 codes : - (as+far+as+costs)+(per+information+unit)+(are+concerned)(J11); (as far as costs)+(per information+unit)+(are+concerned); 're costs'.

- although+(the+classification)+(is+variable)(J19); although+(the classification)+(is variable); 'although the documentary language is variable'.

- (which+he+believes+should+be+kept+in+mind)+(by+those+who+manage)+(science+libraries)(J40); (which must be known)+(by those who manage)+(documentary institutions); 'which documentary institutions must know '.

- (that+will+determine)+(the+appropriate+placement)+(in+a+catalog)(J12); (that will determine)+(placement)+(in a catalog); 'that determines cataloging'.

- when+(the+problems)+(of+input)(J32); when+(the problems)+(of input); 'when the problems of input'.

2 codes : - (at+that+time)+(of+this+report)(J1); (at the time)+(of this study); 'at time of study'.

- (,+which+is+augmented)+(by+a+NPP)(J46); (which is augmented)+(by NPP); 'which NPP'.

- (which+has+been+developed)+(by+NPP)(J5); (which has been developed)+(by NPP); 'which NPP develop'.

- (+substantial+proportion+of+that+which+may+be+written)+(in+a+natural+language)(J12);(what may be written)+(in a natural language); 'natural language'.

- (+since)+(all+functional+units+,+and+not+merely+the+filing+categories+,+can+be+punched)(J26); since+(documentary language units can be punched); 'since documentary language units can be punched'.

2.4.7. G.6

G.6 uses the same computer programmes as G.1 and G.3. It processes codes corresponding to two types of strings : conjoined strings, and strings separated by a punctuation mark that are not conjoined, but are treated as such by the programmes. Since an account of the type of strings processed at this stage requires fairly long quotations, I shall only give a few examples.

To present the examples, I shall represent as a single concatenation what may in fact be the result of several passes in the machine (due to the workings of the computer programmes : see, sections 2.4.2. and 2.4.4.). Thus when several passes are involved, as is typically the case in enumerations, I shall only give the paraphrase of the final code and not of the intermediary codes.

In (i) I present the examples of conjoined strings, and in (ii) the examples of strings separated by a punctuation mark. In this fashion, I shall also provide examples of the workings of G.5 which were not given in the preceding section. In fact, most of the codes on which G.6 operates result from concatenations performed in G.5.

Note that the following type of string is treated as a conjunction : "an outline of..., with a discussion of..." (J3). For reasons which are unclear to me, there is indeed a paraphrase relation between the above construction and the superficial conjunction "an outline of... AND a discussion of..." (cp. Jespersen on the relations between conjunctions and prepositions : Jespersen 1965, 89-90). Also note the following type of string, which is also treated as a conjunction : "concerned primarily with..., most of the material has broad applications in..." (J13). This is paraphrasable as "Most of the material is concerned with... and has broad applications...". A similar treatment has been adopted for "...,(thereby) making..."(J19,not exemplified below), and for "summary of...,including description of..." (J31, not exemplified below).

A weak point of this 'grammar' is undoubtedly the great variety in the structures of the conjuncts it concatenates. In some rules, the conjuncts have much the same structure: for instance, "supported by NPP, carried out by NPP" (J2). But this is far from always the case. Next to the examples given in the preceding paragraph, consider the following example, which is repeated below : "(when the problems of input) and (of the automatic generation of classification information)" (J32). I am afraid that such clearly unnatural segmentations are the price which needs to be paid if one wishes to analyze language data with a fairly simple system such as that presented here. Perhaps the shortcomings under discussion could have been remedied within this system, by increasing the number of 'grammars' and by specializing their tasks. For instance, one could contemplate the setting up of special 'grammars' to deal with subordinate and relative clauses. However, it has not been possible to explore such possibilities within the time available for our experiment.

(i) Conjoined strings.

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- (supported+by+NPP)+,+(carried+out+by+NPP)(J2); (supported by NPP)+(developed by NPP); 'developed by NPP'.

- (an+outline+of+NPP+scientific+translation+program)+,+(with +a+discussion+of+the+problems+of+selection+,+form+,+distribution+,+acceptability+,+and+translation+rights)(J3); (a study of institutional translation program)+(with a study of the development of translations); 'a study of institutional translation program'.

- (searching+the+botanical+drug+literature+for+folk+remedies)+;+(interpreting+and+determining+the content+of+foreign+prescriptions)+(;+and) +(tracing+and+identifying+NPP+references)(J4); (documenting in a particular discipline)+(documenting translations)+(documenting special documents); 'documenting special documents in a particular discipline'.

- (in+addition+to+presenting+a+general+review+of+the+scope+of+the+Federal+Government+'s+role+in+research+and+development)+(,+and)+(a+review+of+the+character+of+the+Federal+Government+'s+scientific+information+activities) (J5); (in addition to a study of governmental scientific activity)+(a study of national governmental documentation); 'a study of national governmental documentation'.

- (is+divided+into+the+following+parts+:+the+present+situation+in+the+United+States)+;+(some+of+the+reasons+behind+the+current+problems)+;+(the+principal+scientific+and+technical+information+activities+of+the+Federal+Government)(J16); (includes national situation)+problems+(national governmental documentation); 'includes national governmental documentation'.

- (additional+information+concerns+availability+of+microfilm+and+photocopying+services+or+photocopying+service)+(only+,)+(the+subject+of+primary+interest+to+the+center)+(,+and)+(coverage+provided+over+pertinent+Soviet+periodical+literature)(J7);(studies photocopying services)+(the discipline of the institution)+(the documents); 'studies institution, discipline, photocopying'.

- (a+general+discussion+of+the+present+state+of+biological+literature)+,+(with+emphasis+on+scientific+nomenclature)+,+(the+life+span+of+biological+literature)+(,+and)+(the+storage+and+retrieval+of+biological+specimens)(J10); (a study of the situation of literature in a particular discipline)+(with a study of the language of a particular discipline)+(the life of the literature in a particular discipline)+(documentation in a particular discipline); 'a study of the literature in a particular discipline'.

- (binary-octal+designations+are+established+for+theorems+,+systems+of+logic)and(for+statements+in+propositional+calculus)(J12); (develops codes for science related to documentation) and(for science related to documentation); 'develops codes for science related to documentation'.

- (concerned+   +with+chemical+information+storage+and+retrieval)+,+(most+of+the+material+has+broad+applications+in+other+disciplines)(J13); (studying documentation in a particular discipline)+(can be used in other disciplines); 'studies documentation in a particular discipline'.

- (working+in+the+following+NUM+areas+:+coding+for+mechanical+searching+systems)+;+(retrieval+and+reproduction)+;+(equipment+for+information+storage)+;+(indexing+,+cataloging+,+and+classification)+;+(translation+by+mechanical+means)+;+(production+and+dissemination+of+information)+;+(use+of+information)+and+(user+requirements)+;+(theoretical+studies)(J14); (studying coding)+(retrieval and reproduction)+equipment+(documentation languages and cataloging)+(mechanical translation)+documentation+(information use)+(user needs)+(theoretical studies); 'studying documentation, equipment and mechanical translation'.

- (based+on+the+results+of+this+study+,+recommendations+were+made+for+application+of+these+findings+to+existing+and+proposed+systems)+(,+and)+(for+further+research+efforts+in+the+evaluation+of+scientific+information+retrieval+systems)(J17); (suggestions for study of systems)[see(ii)below]+(for study of study of documentation systems); 'suggests study of study of documentation systems'.
- (the+universal+code+of+science)+ and+(machine+language)(J24); (the universal documentary language)and(machine language); 'universal documentary language and machine language'.
- (when+the+problems+of+input)+and+(of+the+automatic+generation+of+classification+information)(J32); (when problems of input)+(of mechanical indexing); 'when problems of input and of mechanical indexing'.
- (a+description+of+the+Automatic+Microfilm+Information+System)+and+(how+it+works)(J36); (study of the Microfilm System)+(its workings); 'study of the Microfilm System'.
- (description+of+the+Institute+,+founded in NUM)+(,+and)+(its+services)(J39); (study of a specific institution)[see(ii)below]+(its services); 'study of a specific institution'.

(ii) Non-conjoined strings separated by a punctuation mark.

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- (at+the+time+of+this+report)+,+(the+center)(J1); (at time of study)+(the institution); 'the institution'.
- (binary-octal+designations+are+established+for+theorems+,+systems+of+logic+and+for+statements+in+propositional+calculus)+,+(derived+from+certain+of+their+basic+characteristics)(J12); (develops codes for science related to documentation)[see(i) above]+(from qualitative information); 'develop codes for science related to documentation'.

- (presented+at+NPP+'s+NUM+NPP)+ ,+(held+in+March+NUM)(J15); (presented at NPP)+(held in a certain year); 'presented at NPP'.
- (based+on+the+results+of+this+study)+,+(recommendations+were+made+for+application+of+these+findings+to+existing+and+proposed+systems)(J17); (using the results of the study)+(suggestions for systems); 'suggestions for study of systems'.
- (description+of+the+Institute)+,+(founded in NUM)(J39); (study of a specific institution)+(developed in NUM); 'study of a specific institution'.
- draws+,+(from+reports+by+NPP+on+the +ways+in+which+scientific+personnel+gather+information)+,+(some+observations+as+to+certain+general+practices+and+attitudes+among+scientists)(J40); draws+(from user study)+(studies of scientists); 'studies user'.
- (if+U.S.+and+U.S.S.R.+rates+of+growth+continue+unchanged)+,+(the+U.S.S.R.)(J43); (if international action does not change)+(the specific country); 'the specific country'.

2.4.8. G.7

G.7 works with the same computer programmes as G.2 and G.5 and concatenates successively strings of six, five, four, three and two codes. Its main objective is to arrive at a single code for each sentence, whether articulate, semi-articulate, or inarticulate. When it fails to do so, this is due to the presence of a code for conjunction, and the ultimate reduction is performed in G.8.

Grammatically, the reduction or concatenation in each sentence of all the codes obtained in the preceding grammars to a single code involves various types of strings. These types are given below in (36), with a few examples. In (37), I give additional examples, presenting in succession strings of six, five, four, three, and two codes. No complete lists will be given for the strings of 5, 4, 3 and 2 codes. The only example of a string of six codes is given below. To present the examples of (37), I shall adopt the same conventions as those used in the preceding two sections. Most of the examples cannot be listed under the various grammatical types of strings given below, because many of the concatenations of G.7 involve more than one of these types. For instance, all the codes corresponding to the following bracketed strings are concatenated at this stage : (although this system was designed to be used with edge-punched, hand-sorted cards) (the author) (indicates that) (it can be modified for center-punched card) (which would permit machine sorting)(J26).

Here again, a more systematic (i.e. grammatically more motivated) approach is conceivable, but only at the cost of increasing the number of 'grammars' and specializing their function.

Lastly, note the rewriting as X, equivalent to 'null', when the information of a string is found unnecessary for the purpose of indexing : in the example of J5 given below, and in "(based on papers)+(presented by NPP at national meetings from NUM to NUM)"(J13).

(36)

GRAMMATICAL TYPES OF STRINGS CONCATENATED IN G.7

(i) Subject+Predicate(in the traditional sense).

The only subjects not processed at this stage are those which, rightly or not, were processed in G.0 (e.g. "he+feels",J12) and in G.4 (e.g. "the address+is given", J7). An example of a subject concatenated with the predicate at this stage is "(the charges for each)+(are listed)"(J1).

(ii) Relative clauses not already processed+the code that precedes.

This includes strings of the type "problems+(in+communicating)"(J3), under the assumption that "in communicating" is relatable to a relative clause such as "problems (that were) encountered in...". For instance : "(A+general+description+of+NPP)+(which+was+established+for+the+purpose+of+contributing+to+the+development+of+science+and+technology+by+collecting+,+processing+,+storing+,+and+retrieving+scientific+information)"(J1).

(iii) Strings equivalent to (ii).

The equivalence is a matter of what can be referred to in TG terms as "whiz" deletion (e.g. Langendoen 1970), that is, the transformational deletion of relative pronoun+be. For instance, "services+(available+from+the+center)"(J1) is relatable to a construction with a relative clause such as 'services that are available from the center'. Similarly, constructions like "problem+in..." : see the point made about these in connection with G.5 (section 2.4.6.).

(iv) Subordinate and 'that' clauses with what precedes.

For instance : (concludes that)+(...)(J5), (...)+(so that...)(J16).

(v) Various other strings which were not concatenated before + what precedes or follows.

First, "adjuncts of center strings", when no comma follows ("in this file" in sentence-initial position in J9) or when the comma has already been concatenated with what precedes ("in+this+system+," in J19). Second, strings mentioned under heading (ii) in section 2.4.6. (Preposition+Verb+'Object', concatenated in G.5) : in particular, by-expressions ("by viewing it as...",J12), and purpose ("to determine ways", J2) or relatable expressions ("(procedure)for...",J12). Compare, for instance, "...criteria and procedures FOR evaluating..." and "criteria, and measures of performance which might be used TO evaluate..." (J17). Third, strings separated by a semi-colon that have not yet been concatenated : see example of J29, below.

(37)

EXAMPLES

6 codes : - (in+NUM)+(the+NUM+articles)+abstracted +came+(from+NUM+countries)+(in+NUM+ languages)(J43); (in NUM)+(the documents)+abstracted+came+(from countries)+(in languages); 'abstracting of international documents'.

5 codes : - (this+reviews+the+initial+reasoning+ and+thinking+behind+the+design+and+ construction+of+a+project)+(supported +by+NPP+,+carried+out+by+NPP)+(to+ determine+ways)+(to+affect+the+behavior+ of+scientific+institutions)+(that+are+ responsible+for+the+dissemination+of+ recorded+information+in+order+to+ achieve+a+net+improvement+in+scientific+ productivity)(J2); (studies the thinking behind the development of a project)+ (developed by NPP)+(to develop ways)+ (to affect institutions)+(which document); 'studies thinking behind development of a study of documentation institutions'.

- (the+writer)+(feels+that)+(no+large+ scale+information+retrieval+system)+ (can+be+a+success)+(unless+it+can+handle +searching+for+complex+relationships) (J20); (the writer)+(feels that)+(no documentation system)+(can+qualitative information)+(unless it can search for syntactic relations); 'need to search for syntax'.

4 codes : - (at+the+time+of+this+report+,+the+ center)+(was+planning+to+change+over+ to+a+mechanized+storage+and+retrieval+ system)+(similar+to+that)+(used+by+NPP) (J1); (the center)+(planned to use a mechanical system)+(similar to that) +(used by NPP); 'institution plans use of mechanical system'.

- (the+author)+(concludes+that)+(the+dissemination+of+scientific+information)+(must+be+recognized+as+an+integral+part+of+research+and+development)(J5); (the author)+(says that)+(documentation)+(must be viewed as research); X.

3 codes : - (in+this+file)+(each+term+record)+(contains+all+of+the+document+codes++for+all+of+the+documents+in+which+the+term+appears)(J9); (in this store)+(each term record)+(includes document codes); 'term store includes document codes'. Note that here the relative clause had been - **rightly** or wrongly - processed in G.5.

- (suggests+an+approach+to+the+cataloging+of+the+entire+body+of+written+knowledge)+(by+viewing+it+as+a+finite+series+of+conjoined+propositions)+(which+may+be+ordered+according+to+their+logical+structure)(J12); (suggests theory of indexing)+(by viewing it as topic of science related to documentation)+(which may be organized according to science related to documentation); 'theory of indexing based on science related to documentation'.

- (psychologists)+(should+attend+ +to+the+problem+of+encyclopedic+organization+of+their+knowledge+and+codification+of+the+methods+,+measures+and+results+of+psychology)+(so+that+advantages+of+the+new+techniques+for+automatic+storage+or+retrieval+of+information+may+be+exploited)(J16); scientists+(must study indexing in a particular discipline)+(to use mechanizdd documentation methods); 'indexing in a particular discipline'.

2 codes : - problems+(in+communicating+Russian+science)(J3); problems+(in documenting national information); 'problems in documenting'.

- (this+discussion+of+United+States+scientific+and+technical+information+services)+(is+divided+into+the+following+parts+:+the+present+situation+in+the+United+States+;+some+of+the+reasons+behind+the+current+problems+;+the+principal+scientific+and+technical+information+activities+of+the+Federal+Government)(J6); (study of national documentation)+(includes national governmental documentation); 'study of national documentation'.

- (a+suggested+program)+(to+remedy+this+country+'s+scientific+and+technical+information+ills)(J6); (a suggested program)+(to solve problems of national documentation); 'suggests program for national documentation'.

- (toward+a+procedure)+(for+logically+cataloging+knowledge)(J12); (toward a method)(for indexing by means of a science related to documentation); 'theory of indexing by means of a science related to documentation'.

- (lists+ +NUM+individuals+or+organizations)+[rest of J14]; (lists men and institutions)+(studying documentation, equipment, and mechanical translation)[see paraphrase of code given in the preceding section, 2.4.7]; 'lists scientists studying documentation'.

- (the+computer+research+program+of+NPP)+(is+described)(J18); (the computer program of NPP)+(is studied); 'computer program of an institution'.

- (classification+systems)+used (J25); (documentary languages)+used; 'documentary languages'.

- (systems+of+scientific+and+technical+information+services)+(:+long+range+planning)(J29); (systems of documentation services)+planning; 'future development of documentation systems'.

- (the+simplest)+(being+a+small+,+manually+operated+,+portable+unit) (J35); (the qualitative+-est)(being manually operated machine); 'being manually operated machine'.

2.4.9. G.8

Like G.6, this last 'grammar' uses the same computer programmes as G.1 and G.3, and it processes codes corresponding to conjoined strings. The only difference with G.6 is that a slight modification of the programmes makes it possible to treat the codes for period (S) and for colon (KL) as conjunctions, in the same way as are the codes for conjunctions (such as '*and*'), semi-colon, comma, and for the result of concatenations performed in G.0 (e.g. semi-colon+'*and*'). Consequently, sentences in texts are treated as though they were conjoined; the theoretical foundations of this approach are examined in Part III.

This final stage of the processing raises the problem of coding in all its magnitude. The codes adopted present various deficiencies which are due to the lack of reliable knowledge on discourse structure and to additional difficulties inherent to the present experiment : the problem of the loss of information in the indexing process, and the need inherent to computation for the codes not to exceed a limited number of characters specified in advance in the computer programmes.

Contrary to what has been done in the presentation of G.6, I shall give a paraphrase of the *intermediary* codes, because this is necessary to present a crucial aspect of the problem of discourse structure. As will be remembered, the computer programmes used in G.8 work as follows : in a conjunction *AcBcC*, *A* is first concatenated with *B*, then *A+B* is concatenated with *C*. In G.8, *A* is usually the code for a title, *B* the code for the first sentence of an abstract, *C* the code for the second sentence, etc. The intermediary codes - namely A+B, A+B+C, etc. - raise the problem of discourse structure in terms of how to state the relations between the title and the first sentence, between these and the second sentence, etc.

About the final codes - that is, the codes that serve to represent each abstract as a whole, I must point out that some of them consist of two parts. One part, which is capitalized in the paraphrases presented below, is a label standing for one of the main headings of Gardin-Lévy (Appendix 2). The other part, which is written in small letters in the paraphrases, consists of some additional information which would ideally have to be expressed by means of more specific descriptors. This, however, has not been attempted here, since I only make use of the main headings of Gardin-Lévy in the experiment. The additional information is therefore just extracted from the texts, and juxtaposed to the Gardin-Lévy headings used as descriptors. An example is the code assigned to J1 in the experiment : CENTREDOCPLNMEC. It can be paraphrased as 'DOCUMENTATION CENTRE planning mechanization'. The capitalized part of this paraphrase corresponds to Gardin-Lévy's heading 6. "scientific and technical information institutions (studied individually)", while "planning mechanization" is additional information drawn from the abstract in question.

As far as discourse structure is concerned, I suggest that the abstracts of the experimental corpus present various types of situations which can be tabulated as in (37) below. The first column indicates which parts of an abstract I believe to be 'informative' or not, that is, to correspond or not (partially or completely) to the topic or topics of the abstract in question : respectively, the title (T), sentence 1, 2, etc. (S1, S2, etc.). I shall try to explain more precisely what I mean by 'uninformative' below, by presenting a few examples. The 'uninformative' strings are given between brackets. In the second column I indicate which sentence or sentences are relatable to the 'informative' titles. In the third and fourth columns, I indicate the topics and corresponding strings for abstracts which have been assigned more than one descriptor. In the fifth column, I have marked the abstracts which are discussed, or used as examples of conjoined strings in the rest of this section.

Types: Nr of Abstract	'Informative' parts:	'Informative' title relatable to:	Abstract with more than 1 topic		Abstract discussed or exemplified below
1	T,S1,S2,S3	S1,S2,S3			X
2	(T),S1				
3	(T),S1				X
4	T,S1	S1	FUNCT:T	SOURCES:S1	X
5	T,S1(S2)	S1			X
6	T,S1	S1			
7	T,S1,S2	S1,S2			
8	T,S1,S2	S1	PROF:T,S1	SCI:S2	
9	(T),S1,S2				
10	T,S1	S1			
11	T,S1,S2,S3	S3	FUNCT:T,S3	EQUIP:S1,S2	X
12	T+whole abstract	whole abstr. except S3	CLASS: whole except S3	COD:S3	
13	T,(S1),(S2),S3	S3			X
14	T,S1	S1			
15	T,(S1),S2	S2			
16	T,(S1), S2,S3,S4	S2,S3,S4			
17	T,S1,S2	S1,S2			
18	T,S1,S2	S1,S2			
19	T,S1,S2,(S3), S4	S1,S2,S4			
20	T,S1,S2	S1,S2			
21	T+whole abstract	whole abstract			

Types: Nr of Abstract	'Informative' parts:	'Informative' title relatable to:	Abstract with more than 1 topic		Abstract discussed or exemplified below
22	T +whole abstract	whole abstract			
23	(T),(S1),S2				X
24	T,S1,(S2),S3	S1, S3			
25	T,T,S1,(S2),S3	S1,S3			X
26	T+whole abstract	whole abstract			
27	T,S1,S2	S1,S2			
28	T,S1,S2	S1,S2			
29	T,S1,S2,(S3)	S1,S2			
30	T,S1	S1			
31	(T),S1				
32	(T)whole abstr.				X
33	T,S1,S2	S1,S2	SCI:T,S1,S2	CLASS:T,S1,S2	X
34	(T),(S1),S2				
35	T+whole abstr.	whole abstract	HAND T+whole	EQUIP abstract	
36	T+whole abstr.	whole abstract	HAND:T+ whole abstr.	EQUIP:T, S1	
37	T+whole abstr.	whole abstract			
38	T,(S1), remaining sentences	all sentences except S1			X
39	T,S1,S2	S1,S2			
40	T,S1	S1			
41	T,S1,S2,S3	S1,S2,S3	FUNCT: T, S1	SOURCES: T,S1,S2, S3	
42	T,S1,S2	S1,S2			

Types: Nr of Abstract	'Informative' parts:	'Informative' title relatable to:	Abstract with more than 1 topic		Abstract discussed or exemplified below
43	T,S1,S2,S3, S4,(S5),S6	S2,S6	FUNCT:T, S2,S6	CENTER:S1 S3,S4	
44	T,S1,S2	S1,S2	FUNCT:T, S1,S2	CENTER:T, S1,S2	
45	(T),S1,S2				
46	T,S1,S2,S3, S4,S5	S2,S3,S4,S5	GEN:S1	GEN.ORG.: T,S2,S3, S4,S5	
47	T,S1,S2,S3, S4	S1,S2,S3,S4			
48	T,S1,S2	S1,S2			
49	T,S1,S2,S3	S1,S2,S3	SCI:T, S1,S2,S3	HAND:T,S1, S2,S3	
50	T,S1,S2, (S3)	S1,S2	SCO:S2	EQUIP:T, S1,S2	X

Before giving a few examples of concatenations of conjoined strings in abstracts, I wish to exemplify the above table by discussing briefly a few abstracts whose structure is noteworthy. One of them is J11,.In this abstract, the topic of the title ("Some problems and questions of patent documentation in industry": FUNCTIONING OF STI NETWORKS) is relatable to that of the LAST sentence : "Five suggestions are advanced for a practical solution of patent documentation problems". The other three sentences ("...magnetic drums,...magnetic tape...information capacity")have a topic (EQUIPMENT, storage devices) not explicitly related in the text to the other topic. J13 is an example of an abstract containing two 'uninformative' sentences, in the sense that they convey information irrelevant to indexing : "This is a revised and enlarged edition of NPP. Based on papers presented by NPP at national meetings from NUM to NUM". In J23, the 'uninformative' character of the title and of the first sentence is a consequence of the reduction of proper nouns to NPP : "Basic directions of work at the Experimental Laboratory of Machine Translations" (title). The topic (RELATED SCIENCES, machine translation) can, however, be inferred from the last sentence : "One basic part of their program involves the use of an intermediate language between the input and output languages". Let us also note the double title of J25. Both title and subtitle are relatable to the topic of the abstract, "GENERAL ORGANIZATION OF STI, national" : "Archives, libraries, and documentation centers of Switzerland. Guide through Swiss documentation". The last sentence of J29 is typically uninformative in that it is not relatable to any descriptor : "The paper also includes discussion of problems which would be encountered in the development of such a system". The problems arising in J32 have already been referred to. It is difficult to pin down all the reasons why this text, which is entitled

"The role of large memories in scientific communication" needs to be represented by the descriptor GENERALITIES. One of them is the use of the future tense as in "These memories will serve as indexes to the deluge of technical literature", which makes the abstract appear as a piece of science fiction rather than as a truly scientific document. The whole of J33 has been thought to be relatable to the topics INFORMATION SCIENCE and CLASSIFICATION because the abstract concerns "a suggested classification for the literature of documentation" (title). In J38, the topic (INFORMATION SCIENCE) is expressed in general terms in the title ("Introduction to scientific documentation") and detailed in the abstract, except for the 'uninformative' first sentence : "The book comprises 4 chapters and a subject index". In J45, the title ("... librarianship and documentation") has been labelled 'uninformative' because it is not clearly relatable to the abstract, which is about "Hungary's network of technical libraries". In J50, an 'uninformative' sentence of the type just quoted from J38 occurs at the end :"It is classified and indexed".

In (38), I present and discuss a few examples of strings which are treated as conjunctions, mostly whole texts consisting of a title and of one or more sentences. To present the examples, I shall simplify the conventions adopted in the preceding sections. In particular, I shall only use the + sign (standing for concatenation) between natural language strings and between corresponding codes that are processed in G.8.
In the examples given below, the natural language strings (with only a few codes, such as NPP) are underlined, and the words that are not underlined are paraphrases of the codes that get concatenated in G.8.

- J 1 : (NPP and its activities)+(A general description of NPP which was established for the purpose of contributing to the development of science...by collecting,processing, storing,and retrieving scientific information); (the institution)+(the documentation institution); 'documentation centre'; (preceding string, coded as 'documentation centre')+(At the time of this report, the center was planning to change over to a mechanized storage and retrieval system similar to that used by NPP); (documentation centre)+(institution plans use of mechanical system); 'documentation centre planning mechanization'; (preceding string, coded as 'documentation centre planning mechanization')+(services available from the center); (documentation centre planning mechanization)+(activities of institution); 'documentation centre planning mechanization'; (preceding string, coded as 'center planning mechanization')+(the charges for each are listed); (documentation center planning mechanization)+(lists charges for each); 'DOCUMENTATION CENTRE planning mechanization'.

COMMENTS. Note that the topic DOCUMENTATION CENTRE is already assigned at the stage of the concatenation of the code for the title with the code for the first sentence. The second sentence adds the information 'planning mechanization'. The third and last sentence ("services... and charges...') gives information that is included in the topic DOCUMENTATION CENTRE. Also note that this last sentence has been wrongly segmented :(services available from the center)and(the charges for each are listed). The unfortunate consequence of this segmentation, which was performed in order to be consistent with the system, is the following : the code for "services available from the center" is first concatenated with the code for all that precedes in the abstract ('documentation centre planning mechanization'), and the code obtained by this concatenation ('documentation centre planning mechanization') has then to be concatenated with 'the charges for each are listed'. This could have been avoided by performing the concatenation of subject (services available from the center and the charges for each) and predicate (are listed) AFTER the operation of an additional grammar for concatenating conjunctions of the type "services available from the center AND the charges for each".

- J 3 : (Problems in communicating Russian science)+(An outline of NPP scientific translation program, with a discussion of the problems of selection, form, distribution, acceptability, and translation rights); (Problems of documenting national information)+(A study of an institution's translation program); 'TRANSLATION CENTRE'.

COMMENTS. In this abstract, as in J2, the meaning of the title is vaguer than that of the abstract. The topic can only be established by concatenating the code for the title with the code for the abstract which, in this case, consists of a single sentence.

- J 4 : (Searching medicinal chemical literature)+(Three representative problems of a manufacturer of fine chemicals in searching for information in the medical and chemical literature); (documentation in a particular discipline)+(documenting the user in a particular discipline); 'functioning of STI networks, in a particular discipline+user'; (preceding string, coded as above)+(searching the botanical drug literature for folk remedies; interpreting and determining the content of foreign prescriptions; and tracing and identifying NPP references); (functioning of STI networks in a particular discipline+user)+ (documenting particular documents in a particular discipline); 'FUNCTIONING OF STI NETWORKS,+user, SOURCES in a particular discipline'.

COMMENTS. Here, the title already expresses the first topic (FUNCT) and the first (inarticulate) sentence ("Three representative problems...") conveys additional information concerning a user ("manufacturer"). The enumeration following ("searching the botanical drug literature...") expresses the second topic (SOURCES) because it refers to special types of documents : "botanical drug literature","foreign prescriptions","NPP references". Both the enumeration and what precedes convey information concerning a particular discipline ("chemical", etc.) and, in the final code for the whole abstract this information has been added to the headings of Gardin-Lévy, (cp. 'planning mechanization' in J1). Lastly, note that the enumeration just mentioned is concatenated with what precedes on the basis of the occurrence of a colon; as already pointed out, colons are regarded as a type of conjunction in G.8.

- J 5 : (the Federal Government and U.S. scientific information) +(in addition to presenting a general review of the scope of the Federal Government's role in research and development, and a review of the character of the Federal Government's scientific information activities);

(national governmental documentation)+(a study of national governmental documentation); 'General organization of STI+national+governmental'; (preceding string,coded as above)+(*this article presents a review of the six-point program which has been developed by NPP for improving the dissemination of scientific information PAMONG U.S. scientists and engineers*); (General organisation of STI+national+governmental)+ (studies a program for national documentation); 'General organization of STI+national+governmental'; (preceding string, coded as above)+(*the author concludes that the dissemination of scientific information must be recognized as an integral part of research and development*); (General organization of STI +national+governmental)+X; 'GENERAL ORGANIZATION OF STI+national+governmental'.

COMMENTS. The title of the abstract already expresses the topic, which is also expressed in the first sentence. In this sentence, it was not possible to concatenate at an earlier stage the string "*this article presents...*" with the long preceding string "*In addition to presenting a general review...*". The concatenation is performed at this stage on the basis of the occurrence of a comma between the two strings. While such a concatenation is not justifiable grammatically, it may be semantically. Semantically, the comma between "*In addition to presenting...*" and "*the article presents...*" acts very much like a conjunction : 'presents...and presents...'. The last sentence ("*The author concludes that...*") was coded as *X*, that is, was regarded as 'uninformative' in the sense that the information conveyed was found too trite to be worth indexing. Another possibility would have been to represent it by means of the descriptor GENERALITIES.

- J25 : (partial example): after the concatenation of title, subtitle, and first sentence, the resulting code (GENERAL ORGANIZATION OF STI, national) is concatenated with that for "Descriptive data include historical development, holdings, special collections" (Studies history and holdings); two further concatenations are necessary to process the rest of the sentence :(classification systems used)+(user information).

  COMMENTS. This grammatically unacceptable concatenation of conjoined sentence parts with sentences could only have been avoided by having an additional 'grammar', which would also have taken care of the string "services available from the center and the charges for each" in J1.

- J35 : (partial example) concatenation of the code for "When the document is to be reproduced" and what precedes (HANDLING+ EQUIPMENT) with the code for the following sentence "the appropriate card is selected..." on the basis of the occurrence of an intervening comma. The resulting rewriting is again HANDLING+ EQUIPMENT.

  COMMENTS. Such a treatment of a when-clause as though it were conjoined with what precedes and what follows is the only way I have found of taking care of the intervening comma : "When.......". Another solution would have consisted of setting up a special 'grammar' for such subordinate clauses. Note, however, that in this particular case, the sentence with a when-clause is paraphrasable by means of a conjunction: 'the appropriate card is selected and the(a) document is reproduced'. I shall not further discuss this point here, as conjunction is one of the main topics dealt with in Part III.

2.5. SAMPLE ANALYSES, AND CONCLUSIONS.

2.5.1 Complete sample analysis of one abstract.

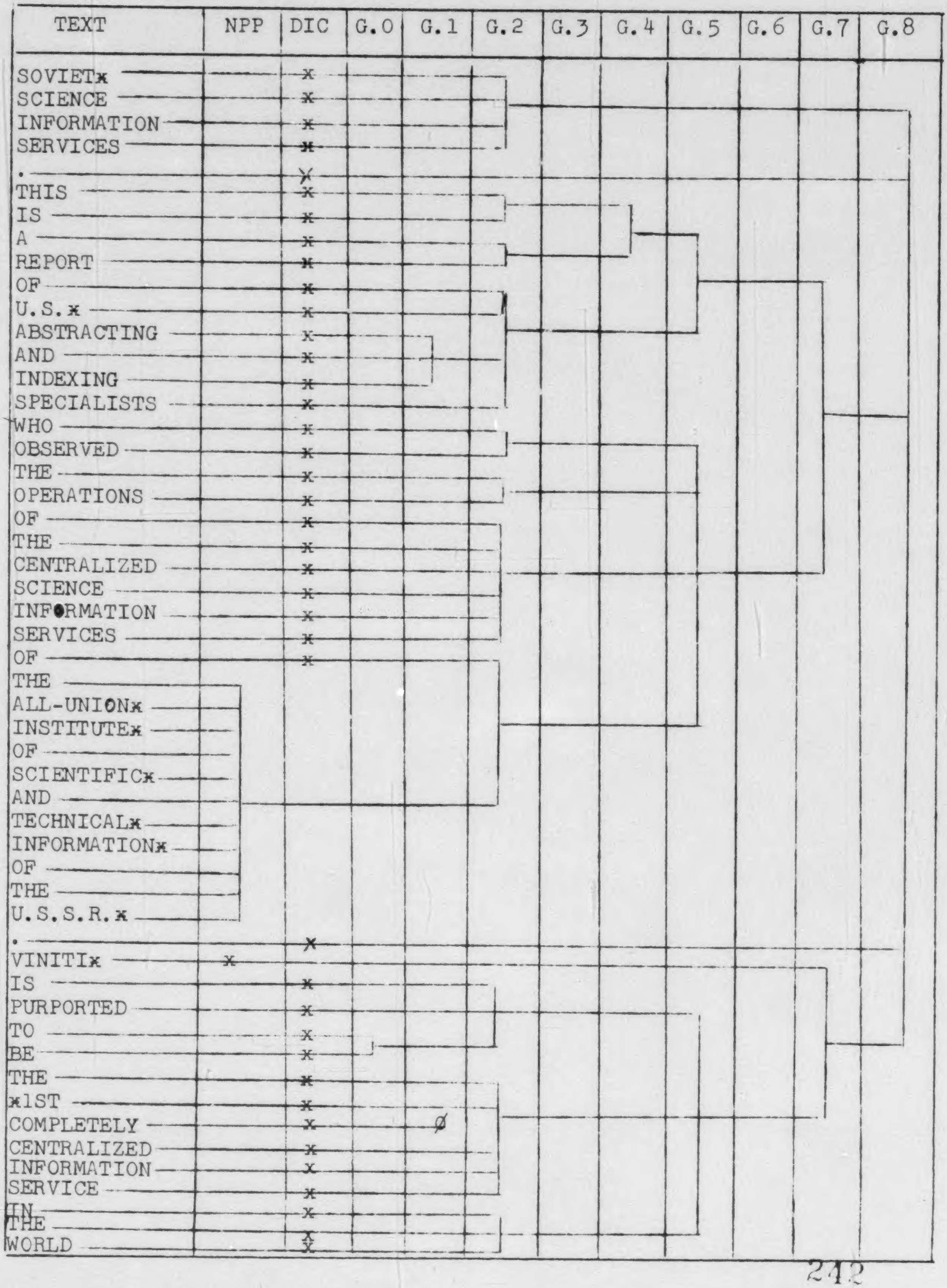
In order to give a synthetic picture of the workings of the system as explained in the preceding two chapters, I now wish to present the complete analysis of one abstract - namely J44 - as it was performed in the experiment and run on the computer. I have selected J44 as an example for various reasons. First, the coding used to analyze this abstract is fairly readable and, although the text consists of more than one sentence it is reasonably short. Besides, it deals with two topics (GENERAL ORGANIZATION OF STI and STI INSTITUTIONS) and one of these topics (GENERAL ORGANIZATION) is by far the best represented in the experimental corpus : 14 abstracts out of 50 have been represented by means of the descriptor in question.

The presentation of the analysis of J44 will proceed as follows. Let us note, first of all, that there are no rules for this abstract in G.3 and in G.6. Besides, to simplify matters, I shall not subdivide the operations of G.2, G.5 and G.7 into those involving 6, 5, 4, 3, and 2 codes, as is done in the computer programmes. Table (39) gives a synthetic picture of the analysis of J44, omitting the codes; the headings NPP and DIC stand respectively for proper-noun reduction and dictionary-lookup. The codes are given in tables (40) to (48). These tables serve to present the dictionary-lookup operations, the reduction of proper nouns, and the successive concatenations, from G.0 to G.8. Each table consists of three columns. In the first table (40), which exemplifies dictionary-lookup for proper nouns, the first column contains the natural language strings, the second, the corresponding codes (in capitals)and the third, a paraphrase of these codes in small letters. In the second table (41), which exemplifies dictionary-lookup after the reduction of proper nouns to NPP, the first column gives the abstract (with a blank at the point where a reduced proper noun occurs), the second, the corresponding codes in capitals, and the third, a paraphrase of these codes in small letters. In the remaining tables (42to48) which show the workings of G.0, G.1, G.2, G.4, G.5, G.7 and G.8,the first column gives the codes to be concatenated in capitals, the second (whenever this is necessary), a paraphrase of the codes in small letters, and the third, the code for the rewriting in capitals.

As will be noted in the illustrations given below, the codes can have up to 15 characters.

(39)

Analysis of J44 (codes omitted).



TEXT	NPP	DIC	G.0	G.1	G.2	G.3	G.4	G.5	G.6	G.7	G.8
SOVIETx		x									
SCIENCE		x									
INFORMATION		x									
SERVICES		x									
.		x									
THIS		x									
IS		x									
A		x									
REPORT		x									
OF		x									
U.S.x		x									
ABSTRACTING		x									
AND		x									
INDEXING		x									
SPECIALISTS		x									
WHO		x									
OBSERVED		x									
THE		x									
OPERATIONS		x									
OF		x									
THE		x									
CENTRALIZED		x									
SCIENCE		x									
INFORMATION		x									
SERVICES		x									
OF		x									
THE											
ALL-UNIONx											
INSTITUTEx											
OF											
SCIENTIFICx											
AND											
TECHNICALx											
INFORMATIONx											
OF											
THE											
U.S.S.R.x											
.		x									
VINITIx	x										
IS		x									
PURPORTED		x									
TO		x									
BE		x									
THE		x									
x1ST		x									
COMPLETELY		x		Ø							
CENTRALIZED		x									
INFORMATION		x									
SERVICE		x									
IN		x									
THE		x									
WORLD		x									

Dictionary lookup of proper nouns.

SOVIETx	NAM/GEO/NAT	Name,geographical,national
U.S.x	NAM/GEO/NAT	Name,geographical,national
THE	THE	
ALL-UNIONx	NOT CODED	
INSTITUTEx	NAM/INS.	Name, 'Institute'
OF	POF	Preposition of
SCIENTIFICx	NOT CODED	
AND	C2	Conjunction, and
TECHNICALx	NOT CODED	
INFORMATIONx	NAM/INF.	Name, 'Information'
OF	POF	
THE	THE	
U.S.S.R.x	NAM/GEO/NAT	
VINITIx	NOT CODED	

(41)

Dictionary-lookup after the reduction of proper nouns.

SOVIETx	NAM/GEO/NAT	Name,geographical,national
SCIENCE	NSG/SCI.	Noun,singular,'science'
INFORMATION	NSG/INF.	Noun,singular,'information'
SERVICES	N2P/SER/VIC.	N plural or Verb,'service'
.	S	Period
THIS	XTHIS	'this'
IS	XIS	'is'
A	A	'a'
REPORT	N2S/STU/RPT.	N singular or Verb,study,'report'
OF	POF	Preposition of
U.S.x	NAM/GEO/NAT	Name,geographical,national
ABSTRACTING	VNG/DOC/ABS.	Ving,documentation,'abstract'
AND	C2	Conjunction,and
INDEXING	VNG/IND.	Ving,'index'
SPECIALISTS	NPL/DIS=AGT	N plural,agent of discipline
WHO	XWHO	'who'
OBSERVED	VED/STU/OBS.	Ved,study,'observe'
THE	THE	'the'
OPERATIONS	NPL/OPE/RTN.	N plural, 'operation'
OF	POF	Preposition of
THE	THE	'the'
CENTRALIZED	VED/ORG/NWK	Ved,institutional organization
SCIENCE	NSG/SCI.	N singular, 'science'
INFORMATION	NSG/INF.	N singular, 'information'
SERVICES	N2P/SER/VIC.	N plural or Verb, 'service'
OF	POF	Preposition of
	NPP	Proper noun
.	S	Period
	NPP	Proper noun
IS	XIS	'is'
PURPORTED	VED/SAY	Ved, say
TO	PTO	Preposition to
BE	XBE	'be'
THE	THE	'the'
x1ST	NUM	numerical information
COMPLETELY	ADV	Adverb
CENTRALIZED	VED/ORG/NWK	Ved,institutional organization
INFORMATION	NSG/INF.	Noun, singular, 'information'
SERVICE	N2S/SER/VIC.	N singular or Verb, 'service'
IN	PIN	Preposition in
THE	THE	'the'
WORLD	NSG/GEO/INT/VAG	Noun,geogr.,international,vague
.	S	Period

(42)

G.0

PTO XBE	(see above)	XTOBE

(43)

G.1

VNG/DOC/ABS. C2 VNG/IND.	(see above)	VNG/DOC/ABS+IND

NAM/GEO/NAT NSG/SCI. NSG/INF. N2P/SER/VIC.	(see above)	NPL/NAT/DOC/NWK
XTHIS XIS		DXS/IS
A N2S/STU/RPT.		NSA/STU
POF NAM/GEO/NAT VNG/DOC/ABS+IND NPL/DIS=AGT	Preposition of Name,geographical,national Ving,document.,abstract and index N plural,agent of discipline	POFNPLNATDOCAGT
XWHO VED/STU/OBS.		WHO/VED/STU
THE NPL/OPE/RTN.		NPT/OPE/RTN
POF THE VED/ORG/NWK NSG/SCI. NSG/INF. N2P/SER/VIC.		POFTHENWKSERVIC
POF NPP		POF/NPP
XIS VED/SAY XTOBE		VED/VEW=PAS+SG
THE NUM VED/ORG/NWK NSG/INF. N2S/SER/VIC.		NSGNUMNWKSERVIC
PIN THE NSG/GEO/INT/VAG		PINNSTGEOINTVAG

(45)
G.4

DXS/IS NSA/STU	Deictic+is N,singular,a,study	NSA/STU

(46)
G.5

NSA/STU POFNPLNATDOCAGT	N,singular,a,study of national documentalists	NSASTUPOFDOCAGT
WHO/VED/STU NPT/OPE/RTN POFTHENWKSERVIC POF/NPP	who studied the operation of the organized service of Proper Noun	WHOSTUNPPNWKACT
VED/VEW=PAS+SG NSGNUMNWKSERVIC PINNSTGEOINTVAG	is regarded(viewed)as NUM organized service in the world	VEDVEWXASNWKSER

(47)
G.7

NSASTUPOFDOCAGT WHOSTUNPPNWKACT	a study of documentalists who study Proper Noun organized activities	NAM/INS/NWK/ACT
NPP VEDVEWXASNWKSER	Proper Noun is regarded as organized service	NAM/INS/NWK/ACT

(48)
G.8

NPL/NAT/DOC/NWK S NAM/INS/NWK/ACT	N,plural,national documentation network Period Name,institution,organized activities	NETWRKNAT+CEN
NETWRKNAT+CEN S NAM/INS/NWK/ACT	national documentation network+ center	NETWRKNAT+CEN (final rewriting)

Comments: The final rewriting is a label corresponding to the headings "General organization of STI" and "STI institutions" of Gardin-Lévy (Appendix 2).

For various reasons, I shall not present the complete computer printout for the analysis of J44 or of any other abstract. For one thing, the computer printout contains various repetitions which are of no linguistic interest. The computer was programmed to print over and over again the strings of codes to be processed. The advantages of doing this is that the workings of the programmes can be checked at any point in the processing. On the other hand, the resulting printouts for the analysis of each single text are extremely long and repetitive, and their reproduction would be a fairly expensive matter. Besides, the original computer printouts are filed at the Computing Centre of the University of Victoria, and the carbon copies which I have are not good enough for xeroxing.

2.5.2. Comments on the step by step concatenations.

The system presented above is based on step by step concatenations which eventually result in the reduction of a text to a single code. Here, I wish to say a few words of the pros and cons of such a system as I see them. The discussion will be fairly brief. A more elaborate discussion would have to be based on more experience than could be gained in the experiment reported here. In particular, it would have been necessary (but it was not possible for lack of time) to extend the experiment to a larger set of texts than the 50 abstracts of the experimental corpus, in order to see what changes would have been needed in the rules to permit such an extension.

I would regard the following as limitations or deficiencies of my system. First of all, I have not come across situations in which a conflict arises between two or more rules, and it is difficult to say how the system could handle such situations. Consider, for instance, the string "documentation centers". A rule of G.2 applied to this string in J25 has the effect of analyzing "centers" as a noun. Suppose we have another rule in G.2 which analyzes "centers" as a noun in the string "on documentation centers". The problem is how the system would analyze a sentence "This paper on documentation centers on problems of...", and how rules segmenting this sentence correctly could be reconciled with the others. If a conflict cannot be avoided between the rules, an obvious solution would be to set up one or more additional subroutines to re-process the codes and to replace them by other codes if the rules have resulted in incorrect segmentations. The existence of such an 'error correcting' subroutine in ACORN ("An Automated Coder of Report Narratives" in the field of medicine) is reported by Shapiro (1967, 157-8). As Shapiro points out, conjunction is a frequent source of incorrect segmentations or linkages in ACORN.

I am also unable to say how my experimental system would handle lexical ambiguities of the type occurring in Kuno's famous example :

(49)

TIME FLIES LIKE AN ARROW.
1. Time passes as quickly as an arrow.
2. A species of flies called "time flies" are fond of an arrow.
3. You shall time the flies which are like an arrow. (Or You shall, as quickly as an arrow, time the flies.) (Kuno 1966, 88).

I have not found any comparable cases of ambiguity in the Janaske corpus.

Thirdly, the system does not display syntactic ambiguities and imposes one interpretation on ambiguous strings : the example given above in section 2.4.2 was "interpreting and determining the content of foreign prescriptions" (J4).

Fourthly, the system has no transformational component that would display explicitly relations between sentence types or sentence constituents - either in the fashion proposed by Harris and his disciples, or in the fashion proposed by the Chomskyan tradition.

Lastly, a grammarian who has examined my examples closely and noted the various inconsistencies which I have pointed out or which appear from the examples will undoubtedly realize that I have taken various liberties with string theory. More generally, a grammarian may feel that it is often difficult to trace direct connections betwean my experimental system of concatenation rules and rules of any recognized linguistic theory. I realize that my experiment is partly open to this criticism. But I cannot accept it as a serious objection insofar as I feel that many of my rules which are not well motivated linguistically involve problems that have been left undiscussed or unsolved by current linguistic theories. In particular, if one objects to the kind of 'text trees' presented in the preceding section, I can only answer that I am not familiar with any other attempt to set up text trees and to mechanize the corresponding analyses for indexing purposes.

Among what I would regard as advantages of my system, I would point out the following. As a computational experiment, the system has worked well from beginning to end. It has been tested with a fairly large corpus. This corpus is certainly not comparable in size to the 1016 abstracts used in the Bély _et al_. experiment (Bély _et al._ 1970, 137), or perhaps to the corpora processed in the SMART system (although I have not seen figures published by Salton or co-workers concerning the number of texts they have analyzed). But my corpus of 50 abstracts is a sizable one if compared to the mostly sentence-bound experiments referred to by Simmons in the state-of-the-art review quoted above.

It is also important to realize the 'modular' aspect of my system. It consists of several parts which could be rearranged in a different order and can thus serve as a tool for experimenting with problems of rule-ordering. Moreover, other computer programmes can be added to the system, should this turn out to be necessary. In particular, it would be possible to improve on the system by providing for right-to-left scans (such scans had been programmed for the experiments reported in my M.A. thesis : J. Noël 1968, 172-3), and for error-correcting procedures of the type mentioned in Shapiro 1967.

I also wish to stress the importance of the multiple-pass recognition system adopted in G.2, G.5 and G.7, by which strings of 7,6,5,4,3, and 2 codes are processed in succession.

Lastly, the existence of 'grammars' dealing with conjunctions after each of the other 'grammars' (except G.4) is based on the assumption that the problem of conjunction and the related problem of certain punctuation marks (such as comma) constitute some of the most difficult problems which mechanical analysis has to face. Various experts in the field seem to agree with such an assumption : Sager 1967 (172), Coyaud (and Siot-Decauville 1967, 39, referring to work on a Russian corpus in geometry by Leontieva), and Shapiro 1967. In fact, I suggest to regard my 'grammars' dealing with conjunctions as basic, and to regard the other 'grammars' as attempts to state conjoinability conditions.

2.5.3. Comments on the coding and on related problems of 'pragmatic competence'.

Throughout the presentation of my experiment, I have insisted on the problematic aspect of the coding, and on the difficulties I experienced in setting up the codes. These difficulties have practical, theoretical, and metatheoretical aspects.

The practical difficulties arise from two decisions which were made in the course of the experiment. One was to limit the number of characters available for the codes of any 'grammar' to a maximum of 15. Such a format provides for many possibilities if arbitrary codes are used : for instance, all the letters of the alphabet in all of the 15 positions available would provide for the coding of 26^{15} different situations. I found, however, that for the purposes of an experimental system it was necessary to use codes in clear, or at least codes consisting of mnemonic abbreviations of plain language words. But this decision had the effect of limiting severely the possibilities of the 15-character coding format. Particularly in the last 'grammars', some of the 15-character mnemonic codes which were used had the effect of imposing undue losses of information on the coding, or the mnemonic function of the codes had to be partly given up in order to avoid such losses of information. This is the reason why I have mostly presented code paraphrases rather than the actual codes in chapter 2.4.

The decision to use mnemonic codesis, I believe, fully justified by theoretical and metatheoretical considerations. First of all, this decision gives recognition to the fact that little or no reliable and detailed knowledge is available about lexical items in general, and about those occurring in a corpus of documentation English like Janaske in particular. I believe that the extent of our ignorance is such that it cannot be remedied by a single author or even by teams of linguists working for many years on a long-term project. A computer count has revealed that the Janaske corpus contains 6766 different word tokens (including capitalized words) and about a thousand of these occur in the first fifty abstracts which served as the experimental corpus. In Part III, I have only been able to examine a small portion of the words occurring in Janaske. This is only natural considering that, for instance, a linguist like Fillmore finds it necessary to devote a whole paper (actually, two papers on the same topic : Fillmore 1969a and 1969b) to a dozen of 'verbs of judging'.

The difficulties which I have experienced with the coding have an additional, metatheoretical dimension if one considers a few examples in the light of the concept of pragmatic competence presented in Part I, or of Gardin's similar concept of "double competence" :

> l'analyse sémantique d'un texte scientifique, fût-il déjà résumé, est une opération éminemment intelligente, qui exige une double compétence, sur le plan de la langue tout d'abord, mais aussi sur le plan de la pensée scientifique elle-même, puisqu'enfin l'on attend plus aujourd'hui d'un documentaliste omniscient qu'il soit capable de dégager indifférement le sens d'un article de physique théorique ou de sociologie. La machine doit être instruite de la même manière dans ces deux ordres de compétence (J.G. Gardin's preface to Bély et al. 1970, xiv).

As examples of the problems I have in mind, I shall examine a few passages from J12, J35 and J11 (see Appendix 3). For convenience, these abstracts are again quoted below:

60)

> Toward a procedure for logically
> cataloging knowledge.
> Suggests an approach to the cataloging of the entire body of written knowledge by viewing it as a finite series of conjoined propositions which may be ordered according to their logical structure. An application of this method to cataloging theorems of modern logic is selected as particularly appropriate for illustrative purposes. Binary-octal designations are established for theorems, systems of logic and for statements in propositional calculus, derived from certain of their basic characteristics. The author recognizes that not all statements can be expressed in as neat a fashion as his examples from the field of logic. He feels, however, that at least substantial proportion of that which may be written in a natural language can be reduced to a standard form that will determine the appropriate placement in a catalog. (J12)

61)

> Automatic selection and reproduction
> of industrial documents.
> The system described employs three established techniques : microfilming, punched-cards, and xerography. Documents to be held on file are microfilmed. Each individual picture is cut off the reel of microfilm and mounted over a special aperture cut in a standard eighty-column punched-card. Data identifying the microfilm are punched in columns available on the card. When the document is to be reproduced, the appropriate card is selected either manually or mechanically from the file of cards and placed in a special projector mounted on a xerographic printer. The required number of full-size documents is then printed automatically at a speed of twenty feet a minute. The system is particularly suited to the filing and reproduction of engineering drawings--600,000 drawings can be recorded and filed in a space of fifty square feet. Machines of varying complexity are available for mounting microfilm on the cards, the simplest being a small, manually operated,

portable unit. Details are given of the Copyflo high-speed printer, and the way in which the system is operated by the Westinghouse Electric Corporation is described, with figures of savings achieved in storage space and in costs of drawing-office supplies and of reproduction drawings. (J35)

(52)

Some problems and questions of patent documentation in industry.
A comparison is made among magnetic drums, magnetic tape, magnetic wire, ferromagnetic cores, punched-cards, punched tapes, and photographic tapes with respect to their access, durability, storage and retrieval time, capacity, and efficiency. It is concluded that the most economic, as far as costs per information unit are concerned, is magnetic tape. It also possesses the greatest information capacity. Five suggestions are advanced for a practical solution of patent documentation problems. (J11)

To begin with, consider the problem of coding as has been done in the experiment, that is, as a descriptive problem. Let us first examine the passages from J12 which are listed below in (53), and in particular the verbs or verbal expressions underlined in these passages :

(53)

- logically cataloging knowledge
- the cataloging of the entire body of written knowledge by viewing it as a finite series of conjoined propositions which may be ordered according to their logical structure.
- not all statements can be expressed in as neat as fashion as his examples from the field of logic
- at least substantial proportion of that which may be written in a natural language can be reduced to a standard form that will determine the appropriate placement in a catalog.

It seems reasonable to regard these passages as semantically equivalent, to capture this equivalence by assigning the descriptor CLASSIFICATION AND INDEXING to J12 as has been done in the experiment, and to regard the underlined expressions as equivalent on the basis of this equivalence. But even as a descriptive problem, I have found that the coding of such equivalences could only be handled empirically and left open to further research. One reason is that no linguistic theory known to me would be able to display the semantic equivalence (for instance, in terms of implication rules as proposed by Leech 1969) that underlies the grammatical diversity of the expressions under consideration.

Another reason is that the equivalence in question may be a matter of pragmatic competence. Only an expert in information science may be able to perceive the equivalence,and it may hold only in the English of information science : for instance, everyday English would equate "expressed in a neat fashion" with "well written", etc., and not with "cataloging", and only in the logician's or the linguist's jargon could the expression in question be equated with a verb like "formalize".

The problem of pragmatic competence arises most clearly at the discourse level in J35, the first sentence of which refers to a system based on techniques of "microfilming, punched-cards, and xerography". From the following sentences, it appears that one of the main characteristics of the system in question is an extremely specific chronological sequence in the application of the three techniques mentioned in the first sentence. Here then, discourse structure appears to be determined by the very structure of the "system" described, as set up by the system's designers. Here again, my coding could only be empiric, since I do not have these experts' expertise.

To anticipate a discussion presented in Part III, let us now assume that "for all conjunction" (including "and", and somecommas in written language) "a common topic is necessary" (Robin Lakoff 1970, 55). If this assumption and that made in the preceding paragraph are correct, then the semantic equivalence or common topic in "microfilming, punched-cards, and xerography" (J35) is a matter of pragmatic competence, and the coding which needs to capture this common topic will have to be based on the non-linguist's expertise just referred to. This is also particularly clear in the following passage from J11 : "A comparison is made among magnetic drums, magnetic tape, magnetic wire, ferromagnetic cores, punched-cards, punched tapes, and photographic tapes with respect to their access, durability, storage and retrieval time, capacity, and efficiency". In order to capture the "common topic" in the first enumeration, I have assigned the same code - paraphrasable as "storage equipment" - to all the conjuncts of this enumeration. My knowledge of the subject, however, did not enable me to find a satisfactory label for the common topic in the second enumeration ("with respect to..."): the only sensible code I could arrive at (in G.3) is paraphrasable as "with respect to some qualities". Moreover, I would stress the following point. The type of expertise involved here is one which concerns creative aspects of language use : whereas a word like, say, (human) limb is equatable to "legs and arms", it seems to me that a list of 'storage devices' and of their properties in computer science is open-ended, because a computer scientist can at any time invent and name a new storage device, or discuss some new property of such devices. In Part III, I shall not deal systematically with problems of "symmetric" or reversible conjunctions as illustrated above in J11, in order to concentrate on "asymmetric" conjunction (R. Lakoff 1970).

2.5.4. Conclusions.

The mechanized indexing system under discussion was set up with a limited objective in mind. The purpose was to show that it is possible to mechanize the reduction of abstracts in a particular field to a single code standing for a descriptor in this field, and to do this by means of step by step concatenation rules based on an adaptation of string theory and its extension to discourse. This means that the system has been designed as a system for reducing surface structures (corresponding to abstracts) to surface structures (corresponding to descriptors). I am not acquainted with any similar attempt to set up purposefully a mechanized 'surface-to-surface' system. For this reason, it is difficult to compare my system with any other system for automatic indexing of abstracts. The Bély et al. experiment, in particular, which is the only one known to me that has underlying metatheoretical assumptions similar to mine, makes use of what might be referred to as deep structure representations based on the SYNTOL relations.

To conclude, I submit that the interest of my experiment lies in the gap between its full success as an experiment in computation, and its shortcomings with respect to the ideal metatheoretical requirements put forward in Part I : in particular, the ideal of a reversible procedure based on a linguistic study of pragmatic (or double) competence.

One theoretical deficiency of the system lies undoubtedly in the lack of elaboration of the rules, and in various inconsistencies discussed in the preceding chapter or appearing from the illustrations. One of Gardin's recent comments is applicable here : "les macro-mécanismes de l'analyse documentaire (...) sont des sortes de "courts-circuits" d'une analyse plus fine du discours, au sens où l'entendent les transformationalistes (Z.S. Harris et ses épigones aux Etats-Unis, Maurice Gross en France, etc.)" (preface to Bély et al. 1970, xvii).

The most serious deficiency, however, has to do with problems referred to in the preceding section in connection with the codes used in my experiment at the dictionary-lookup stage and in the various successive 'grammars'. In the preceding section, I have mentioned my difficulties with coding conceived as a descriptive problem. But description is only the crudest stage of theoretical investigation. To be adequate, a mechanized indexing system needs to have predictive power. The system under discussion, however crude it may be, suggests the magnitude of the problem in the following terms : to lend a mechanized indexing system predictive power one would have to be able to enumerate, just for the recognition of surface structures in texts, all the possible rules in at least 9 'grammars' operating in succession. Moreover, if what has been said in the preceding section is correct, the setting up of such a generative system would have to rely on what I have referred to as 'pragmatic' or "double" competence.

One might be tempted to consider that the need to predict and state a great number of detailed rules in the various 'grammars' imposes undue rigidity on the system I propose. I feel, on the contrary, that this feature of my system raises the real problem of linguistic theory and of automatic indexing, namely that of stating a finite number of rules that will account for what Chomsky calls the creative aspect of language (Chomsky 1965, 6). I also believe that, from the point of view of linguistic theory, it does not make sense to have a machine establish what a theory cannot predict, or to have the machine 'discover' rules which the system designer has failed to state.

The following, and last part of this thesis (Part III) is based on the assumption that at least some of the shortcomings of my mechanized indexing experiment can be remedied on the basis of a particular conception of semantic deep structure. I assume that this type of semantic investigation is a necessary addition to the theoretical study of the string aspects of language, that such an addition is necessary to serve the predictive purposes of a linguistic study of pragmatic competence, and that a transformational apparatus can eventually be set up to relate the semantic representations to the surface representations. In this sense then, Part III as a whole can be regarded as a conclusion of Part II.

FRANÇOISE & JACQUES NOËL-DAGNEAUX

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ALLÉE DE LA CENSE ROUGE, 50
(B-) 4200 OUGRÉE (SART-TILMAN)
BELGIQUE
TÉL.: (04) 65.64.79

PROF. DR. J. NOËL, M.A.
VRIJE UNIVERSITEIT BRUSSEL
SECTIE GERMAANSE FILOLOGIE

FL006344

PART III : PROBLEMS OF SEMANTIC REPRESENTATION

3.1. THEORETICAL BACKGROUND : CASE THEORY AND BEYOND.

3.1.1. Introduction and outline.

Although I have intended this part of my thesis to be a study of some aspects of English from a TG point of view, there are obvious differences between my preoccupations and those of the TG studies with which I am acquainted. Superficially, the difference can be characterized as follows. The TG linguists' examples consist by and large of sentences they invent : they range, let us say, from almost moronic three-word sentences about "John" or "Mary" to huge sentences by means of which the TG linguist attempts to throw some light on the grammatical or semantic possibilities of language. My examples, as far as possible, are drawn from a corpus of non-everyday English, and my ultimate preoccupation is with texts or discourses, rather than 'sentences' as the observable objects with which TG linguists are usually concerned. Furthermore, the TG linguists' selection of problems is entirely determined by the state of TG research. A topic or problem is judged as interesting or, on the contrary, as trivial on just this basis. My selection of problems is only partly made on such a basis, and many of my problems are not yet in what current TG linguists would describe as a 'researchable' form. What I do share with TG linguists - and no doubt with many other students of language - is a conception of language as something systematic, the system of which is partly independent of the examples chosen for study. I believe that there would be no point in studying documentation English (nor in fact any language variety , including everyday language) unless one can throw light on some linguistic universals, that is, on some points which can tell us what languages in general are like. I assume that my study of English abstracts in the field of documentation can serve such a purpose. The examples I have selected for this part of my study are drawn from the whole of the Janaske corpus, because I felt that my purpose would be better served in this way than by limiting myself to the experimental corpus of 50 abstracts dealt with in Part II.

More fundamentally, my preoccupations in these chapters on semantic representation can be summed up as follows :

(i) I have tried to strike a balance between two approaches to problem selection : the TG linguists' practice of inventing their examples (including unacceptable sentences) on the sole basis of the state of TG theories, and the pre-Chomskyan practice of basing one's investigation on a selection of sentences which non-linguists would use or have actually used.

(ii) My ultimate concern is with extending the observational and theoretical tools set up by TG linguists (particularly by and around Fillmore) to the study of texts.

(iii) My main preoccupation is how the linguist can arrive at a semantic representation by comparing and manipulating a selection of observable data or 'words on the page'. In this, I follow a practice which has become more and more common among many TG linguists in recent years as a result of "an increasingly pessimistic attitude toward formalism" (Lee 1971, ii). Rather than attempt to write rules whose objectives are beyond the powers of current theories, I have concentrated on the question of the nature of the linguist's arguments , because I believe this question to be a fundamental one. The tree diagrams which I present should be regarded as a convenient (and, I think, revealing) way of displaying the consequences of I propose, rather than as statements of rules.

(iv) As my title suggests, I am concerned with semantic representation as such. This means that I only deal with what belongs the base of a generative linguistic theory and that I do not attempt to set up transformations. My claim is that the nature of the major problems I am concerned with does not yet lend itself to a transformational treatment. One of the consequences is that the way in which this part of my thesis is organized does not take account of current hypotheses about a transformational cycle (see, for instance Mc Cawley 1970).

(v) I have chosen to work within a theoretical framework set up by Charles Fillmore and to attempt an extension of this framework, chiefly on the basis of some recent work on conjunction by Zellig Harris (1968) and Robin Lakoff (1970). I believe, however, that some parts of my investigation could serve as a starting point for a comparative study of what Fillmore's proposals and completing or diverging frameworks (for instance, generative semantics) could achieve when dealing with the same problems. In particular, I go out from Fillmore's conception of a methodological separation between phrase-structure rules and lexical entries in the base of a generative theory of language, a hypothesis inherited from Chomsky 1965.

To me, one of the primary tasks of case theory - as well as one of its unique features - is that of correlating grammatical (and observable) facts such as what sentence constituents can be chosen as subject, as object or as prepositional phrase, with semantic facts concerning the nature of these constituents. Indeed, this bringing together of grammatical and semantic predictions constitutes one of the major concerns of this part of my thesis - one which parallels my concentration on linguistic argumentation (iii).

(vi) My selection of problems is determined by a combination of three considerations : the theoretical framework which I have chosen; the nature of my data (a corpus of abstracts and a corresponding metalanguage); and what I believe to be the major shortcomings of the experiment presented in Part II. Though I have not been able to present a detailed semantic analysis of any abstract of the Janaske corpus or of any entry of the Gardin-Levy concordance, I believe that the problems I have selected are relevant to a description of both the metalanguage and object-language under investigation, in accordance with the metatheoretical assumptions of Part I.

(vii) I realize that all the problems I have selected for discussion could have been treated more thoroughly, and must admit that some important problems have not been dealt with at all. For instance, I have no original proposal to make about the question of 'nominalization', which is an obvious problem in a corpus of abstracts. My concentration on a few "cases" leaves little room for discussion of other "cases" which a thorough semantic analysis of the conceptual field of documentation would require. For one thing, this thesis is long enough as it is. Moreover, I have chosen to take the responsibility of dealing less thoroughly than could have been done with a limited range of problems, at the expense of others, rather than concentrate on a single point and ignore various others which I believe to be related, even though current theories fail to capture the relation.

(viii) Since my intention is to go beyond Fillmore's exploration of "the elementary structure of the "propositional" core of simple sentences" (Fillmore 1968b, 28-29), it was to be expected that the linguistic literature available to me proved, on the whole, to be of little direct help for my descriptive purposes; the only notable exceptions are some fundamental points made by authors mentioned in this section. For this reason, and also because there is no point in duplicating various reviews and discussions of TG linguistics mentioned in my bibliography (including a paper of mine : J. Noël 1971), I do not attempt to explain various well-known features or technicalities of TG linguistic theories in the present chapter (3.1.). Nor do I attempt to give a complete account of Fillmore's case theory and related frameworks; a critical review of the literature on case would in itself require a monograph (see the long bibliography given in Fillmore 1970c). The few technicalities about TG theory that are directly relevant to my problems will be presented in due time in the course of the discussion.

My discussion of problems of semantic representation falls into five main chapters. The present chapter (3.1.) is entitled: "Theoretical background : case theory and beyond". It consists of three sections, in addition to the present introduction (3.1.1.). The second section (3.1.2.) presents a brief account of the phrase-structure, or constituent-structure subcomponent of the base as set up by and around Fillmore. The third section (3.1.3.) summarizes some of the most recent proposals made by Fillmore about lexical entries. The last section is intended to trace connections between two types of proposals - a task which, to my knowledge, has so far not been attempted : on the one hand, a hypothesis most thoroughly explored by Annear Thompson according to which a sentence with a restrictive or non-restrictive relative clause should be derived from a pair of conjoined sentences; on the other hand, recent work by Zellig Harris (1968) and Robin Lakoff (1970) on sentence conjunction and discourses, as well as a few other relatable proposals. The discussion is centred on problems of identity : the partial identity which, according to Zellig Harris and Robin Lakoff, is required between conjoined sentences, the identity between noun phrases which needs to be stipulated in all known accounts of relative clause formation, and the broader problem of discourse cohesion. The major interest of Robin Lakoff's treatment of conjunction, as far as the purposes of this study are concerned, is the distinction she explores between *symmetric* or reversible sentence conjunction (as in '*John is a teacher and Mary is a chemist*'), and *asymmetric* conjunction (as in '*Veni, vidi, vici*').

The second chapter (3.2.), which is entitled '*A discussion of...*' is the one which comes closest to the usual preoccupations of Fillmore and his followers. It deals with problems concerning expressions such as '*A discussion of -*', '*the author discusses-*', which are used in many abstracts to introduce a description of what the abstracted document is about. The four areas of concentration in this chapter are :

(i) arguments in favour of a locative analysis of, say, "*this paper*" in sentences of the type '*In this paper, the author discusses__*','*This paper discusses—*', etc.

(ii) arguments in favour of an analysis of *x* in sentences like 'The author discusses *x*' as the realization of a case which I propose to label the Topic case ;

(iii) an attempt to account for the semantic relatedness between sentences such as '*This paper discusses—*', '*In this paper, the author discusses——*', '*A brief discussion of—*', '*Summarizes—*', '*Included in this paper is a discussion of—*', '*This article is on——*', etc.

(iv) the theoretical status of what Jespersen (1965, 308) calls "inarticulate" sentences (cp. "*Thanks*" and '*The problems of—*') and "semi-articulate" sentences (cp. "*Thank you*" and '*Discusses the problems of—*'), and the relations between such sentences and "articulate" sentences ("*I thank you*"), both active ('*The author discusses—*') and passive ('*x is discussed*'). Jespersen's distinction provides the main subdivisions of the chapter : "*Articulate sentences : active*" (3.2.1.), "*Articulate sentences : passive*" (3.2.2.), "*Semi-articulate and inarticulate sentences*" (3.2.3.).

The third chapter is entitled "*Conjunction, relative clauses, and presupposition*" (3.3.). The first section is an attempt to explore some marks and factors of identity which are partly common to sentence conjunction and to constructions with relative clauses. The second section (3.2.) carries the discussion a step further and brings in the additional problem of the relatedness between certain noun-phrases with relative clauses and certain lexical items : for instance between "*what's known*" and "*knowledge*" (J 407) (cp. Bach's hypothesis about noun-phrases : Bach 1968). I argue that the observations made in these two sections contradict some of the rules of relative clause formation set up by Langendoen (1970, 141-3) after the Annear Thompson hypothesis, and that they suggest the need for an account of relative clause formation based on Langendoen's concept of "projection" (In '*The whale swallowed* Jonah', then, "we would say that the argument *the whale* receives the specification SWALLOWED JONAH and *Jonah*, SWALLOWED BY THE WHALE" : Langendoen 1967, 105). In the third section (3.3.3.), on "*Asymmetric conjunction and documentation*", I argue that asymmetric conjunction is a central feature of the conceptual field of documentation as appears from the equivalence between the word "*documentation*" and such expressions as "information storage AND retrieval". Various attested examples are presented in order to show that, in the conceptual field of documentation, asymmetric conjunction can be defined in terms of a set of other, parallel, and partly equivalent, constructions : for instance, the possibility of having "searching FOR information retrieval" (J 998), next to "literature searching AND retrieval" (J 1025). The last sectio of the chapter (3.3.4.) examines the relations between asymmetric conjunction and lexical presupposition as discussed by Fillmore. It also discusses the problem of asymmetric conjunction in the field of documentation in relation to Lyons' concept of implication, which hinges on sentence conjunction (Lyons 1968, 455 : 'I bought some flowers' "implying" 'I bought some tulips AND some roses', etc.), and to the problem of synecdoche: for instance, "retrieval" standing for the more usual expression "information storage and retrieval" in "On retrieval system theory" (J 1044).

On the basis of observations made in the preceding chapter, Ch. 3.4. proposes an analysis of asymmetric conjunctio in terms of an extension of case theory (3.4.1.), and returns to the question of Langendoen's projection and relative clause formation (3.4.2.). The last two sections present analyses of various attested examples in terms of the representations I propose for asymmetric conjunction and cognate constructions (3.4.3. and 3.4.4.).

The last chapter of my semantic discussion is entitled "Some Complex Instruments" (3.5.). After showing that noun phrases with such words as "machine" and "system" display properties typical of Fillmore's Instrumental case (3.5.1.), I discuss various other examples drawn from the corpus under investigation which present difficulties for case theory as it currently stands : for instance, "As machines learn..."

(J 1096) (3.5.2. Some problematic examples). In a third section (3.5.3.), I examine USE and other instrumental predicates, in order to define some sentence types which, to my knowledge, have never been discussed in the literature : consider, for instance, the relation between 'system' and 'techniques' in the sentence "The system (...) EMPLOYS three established techniques (J 35). The next two sections are devoted respectively to the instrumental (3.5.4.) and locative roles of NP's with 'system' and related words, in connection with Fillmore's proposals to set up multiple case representations (Fillmore 1969a) : compare, for instance, "a system WHEREBY..." and "a system IN WHICH". The last section is entitled "Anaphoric and cataphoric uses of 'system'". In this section, I am chiefly concerned with the role of the word 'system' in discourse structure. In particular, I examine deictic NP's like 'this (the) system', which can occur either in the first sentence of an abstract to refer to sentences that follow, or in the nth sentence of a text without any previous occurrence of the word in the preceding sentences.

The amount of attention I devote to words like 'system' is justified not only by their intuitively obvious importance as probable Instruments in case theory, but also by their role in the conceptual field of documentation, both in the meta-language (the Gardin-Lévy 'concordance') and in the object-language, as is suggested by the following title : "Documentation, information retrieval, and other new techniques" (J 966).

3.1.2. Constituent-structure rules.

This brief presentation of Fillmore's proposals about constituent-structure rules is based on two main sources, in addition to Fillmore's publications : Goldin's Spanish case grammar, and the so-called U.C.L.A. grammar (Stockwell *et al.* 1968).These, as well as Fillmore's early versions of case theory are partly outdated, since Fillmore has modified his thinking on several points (particularly Fillmore 1970b). These modifications, however, are mostly irrelevant to the main points of my semantic discussion, with one notable exception : in the ensuing discussions, I shall follow Fillmore 1970b and others (cp. Stockwell *et al.* 1968, Langendoen 1970, 188-190) in assuming that modality and terse can be represented as predicates in a 'higher' sentence (which I shall ignore) and I shall write S for what Fillmore used to symbolize as P.

Fillmore's first version of the constituent-structure component can be described as follows :
"every Sentence structure (S) consists of a Modality (M) and a Proposition (P). The Modality constituent includes the auxiliary and other sentence modifiers. The Proposition contains the major lexical categories. Specifically, the Proposition consists of a Verb (V) and one or more case categories, each of which is divided in turn into a Case Marker (K) and a Noun Phrase (NP) (...) The exact nature and number of the case categories remains open to a great deal of investigation. Fillmore lists eight and says that there are certainly others. The four cases which are of immediate importance to the ensuing discussion are the Agentive (A), Dative (D), Instrumental (I), and Objective (O)" (Goldin, 5).

Note, in particular, that Fillmore's list of cases is open-ended. This lack of explicitness is undoubtedly one of the weak points in Fillmore's proposals. Furthermore, his theory can be said to rest on four main assumptions.

Assumption 1.

The cases reflect "certain types of judgments human beings are capable of making about the events that are going on around them, judgments about such matters as who did it, who it happened to, and what got changed." (Fillmore 1968a, 24). The case analysis of a given sentence appeals partly to such conceptual judgments, and partly to criteria of the type discussed under Assumption 2. On the basis of these conceptual judgments, "it is feasible to show that some syntactically different words are in fact semantically identical", as for instance *like* and *please* (*op. cit.*, 30).

To explain more systematically what the conceptual judgments involved in case analyses are about, Fillmore has provided verbal definitions for the cases. The definitions he gives in the two main published versions of case grammar with which I am acquainted are tabulated below in (1); I have changed the order of presentation adopted by Fillmore in order to display the correspondences that exist, were it only partially, between the two versions.

(1)

Agentive (A), the case of the typically animate perceived instigator of the action identified by the verb.	*Agent* (A), the instigator of the event.
Instrumental (I), the case of the inanimate force or object causally involved in the action or state identified by the verb.	*Instrument* (I), the stimulus or immediate physical cause of an event.

Dative (D), the case of the animate being affected by the state or action identified by the verb.	*Experiencer* (E), the entity which receives or accepts or experiences or undergoes the effect of an action (...)
Locative (L), the case which identifies the location or spatial orientation of the state or action identified by the verb.	*Goal* (G) (*op. cit.*, 117) [no verbal definition is given but it is contrasted with *Source*, which suggests that it is equivalent to a former Dative with a spatial sense] *Source* (S), the place from [the text says, mistakenly, to] which something is directed.
Factitive (F), the case of the object or being resulting from the action or state identified by the verb, or understood as a part of the meaning of the verb.	*Result* (R), the entity that comes into existence as a result of the action.
	Counter-Agent (C), the force or resistance against which the action is carried out.
Objective (O), the semantically most neutral case, the case of anything representable by a noun whose role in the action or state identified by the verb is identified by the semantic interpretation of the verb itself; conceivably the concept should be limited to things which are affected by the action or state identified by the verb (...)	*Object* (O), the entity that moves or changes or whose position or existence is in consideration. (Fillmore 1969a, 116).
Essive : providing for sentences of the *N be N* type. (Fillmore 1968 a, 24-25 and 84).	

In addition to the new definitions tabulated above in the right-hand column, the second main published version of case theory (1969a) allows for the possibility of a given surface constituent having more than one case assigned to it : for instance, Agent and Source for the subject of an active sentence with *sell*.

Moreover, in later unpublished work, Fillmore (1970 b) proposed the following list of cases : A, I, E (in the non-spatial meaning of the former Dative), G (in the spatial meaning of the former Dative), S (in the directional meaning of the former Locative), Place (in the non-directional meaning of the former Locative), Path (as in " he travelled *via New York*") Time (as in "*Summer afternoons* are warm"). He suggests that Result can be merged with Goal by generalizing the definition of the latter. He again insists that this list of cases is only tentative and provisional. It seems to me, however, that the most important change which has taken place in the latest unpublished version of case theory is that Fillmore seems to adopt more and more general or abstract definitions for his cases. As a result, many of the original definitions have often become inapplicable. This appears most clearly in the treatment of clauses. In the 1968 version of case theory, Fillmore considered that O was the only case that could be realized as a clause (S) (1968a, 28). He now recognizes that this possibility also exists with other cases, such as I as in "I persuaded John to leave *by promising him a reward*". Similarly, Binkert (unpublished) suggests that the following sentence contains a sentential Dative (or Goal) : "John devotes a great deal of time *to studying rocks*". The hypotheses which I shall put forward in 3.4. carry such generalizations of I and Goal a step further.

Assumption 2.

The cases are also assigned, and defined, on the basis of observations about surface grammatical structure. First, Fillmore defines two negative conditions. One is that "only noun phrases representing the same case may be conjoined" (Fillmore 1968a, 22). The other is that "although there can be compound instances of a single case (through noun phrase conjunction), each case relationship occurs only once in a

simple sentence" (*op. cit.*, 21). Next to noun-phrase conjunction, Fillmore seems to recognize other constructions corresponding to compound instances of a single case, such as the compound instruments '*The car's fender*' and '*The brevity of your speech*' in the following sentences and their paraphrases : '*The car's fender* broke the window' ('*The car* broke the window *with its fender*'), '*The brevity of your speech* impressed us' ('*Your speech* impressed us *with its brevity*') (*op. cit.*, 23).
In his later, unpublished, work (1970b), Fillmore recognizes yet other possible constructions for compound or complex realizations of a given case : for instance, the Locative in 'He slept *in a park on a bench under a tree*'.

The positive criteria for assigning a given case concern certain regularities in - or correlations between - various syntactic facts which Fillmore posits to be matters of surface grammar : in particular, subject and object selection, prepositional phrases and the choice of certain prepositions which appear to be typical of certain cases. For instance, '*a hammer*' and '*the key*' are analyzed as Instruments on the basis of such evidence as provided by the following sentences : '*the key* opened the door', '*A hammer* broke the window', 'John opened the door *WITH the key*', 'John broke the window *WITH a hammer*' (Fillmore 1968a, 22 and 25). It is a matter of further research to show whether or not such criteria will remain applicable under Fillmore's recent, and more abstract, definitions of the cases. Note, for instance, that like 'with the key' and 'with a hammer', 'by promising him a reward' can become a subject when one of the above examples is paraphrased as : '*The promise of a reward* persuaded John to leave'.

Assumptions 3 and 4.

These assumptions have not been made explicit by Fillmore himself, but they can be inferred from his treatment of personification in the sentence 'x A hammer broke the glass with a chisel' : "under the personification interpretation", he points out, the sentence "becomes acceptable", and he adds : "what is important to realize is that these interpretations, too, are explainable by reference to exactly the same assumptions appealed to in explaining their 'face value' interpretations" (Fillmore 1968a, 22), that is, presumably to the fact that 'a hammer' when personified is regarded as animate and can therefore be analyzed as Agent. To me, such an analysis rests on two implicit assumptions. One is that 'predicates' with their "case-frame features" (see 3.1.3.) are inserted first, as has been argued by Stockwell et al. 1968. Secondly, considering that Fillmore regards the above sentence as acceptable "under the personification interpretation", considering also that a word like 'hammer' would presumably be assigned an inherent feature [-Animate] according to Chomsky 1965, and that such a feature is incompatible with the definition of Agent, one must conclude that (a) either Fillmore wishes to give up Chomsky's system of unique inherent features, or (b) that the verb selected changes the feature [-Animate] of 'hammer' into [+ Animate]. To my knowledge, Fillmore has never discussed either (a) or (b). What is clear, however, is that his treatment of specifications such as human as the "presuppositions" associated with certain verbs is very similar to Chomsky's use of selectional features, and that in both cases it is necessary to take a stand about (a) and (b). Moreover, there is some overlap between "presuppositions" such as human (see 3.1.3.), and the role of specifications like animate in the definitions of the cases.

As far as the descriptive purposes of this study are concerned, case theory as it currently stands has serious deficiencies. Fillmore's versions of the theory as well as the various studies based on it (e.g. Stockwell *et al.* 1968, Langendoen 1970) and the criticisms addressed to it (in particular, Doughterty 1970) are all based on very simple sentences of everyday language. There is so to speak no overlap between the verbs or predicates discussed by Fillmore, his followers and critics, and the verbs or predicates that need to be discussed in this study. as they occur in documentation abstracts and in a corresponding metalanguage.

Goldin's constituent-structure rules, which correspond to the 1968 version of case grammar are given in (2) :

(2) (a) S --> M P

(b) P --> V (O) (D) (I) (A) (...)

(c) O, D, I, A --> K NP

(d) NP --> Det (N)(S)

(Goldin, 77 and 63)

K in (2) (c) is a Case Marker (Fillmore 1968a, 44-5) : thus, when *K NP* serves to rewrite an Agentive, it is mostly realized as *by NP* in passive sentences, while this *K* is realized by the word order in active sentences. As shown in (2) (b), one of the main functions of the constituent-structure component is to define "case-frames" which can be associated with words represented as verbs or verb-like elements (see 3.1.3.). In (2) (d), "the linked parentheses mean that at least one of the two linked elements must be chosen"; rule (2) (d) "abbreviates three possible constituent structures for Noun Phrases" :

(a) Det N

(b) Det S

(c) Det NS

(*op. cit.*, 63).

Following various proposals made in the literature, Goldin suggests that relative clauses are introduced on the basis of rule (2) (d).

Following the U.C.L.A. grammar, two further rules could be added to Goldin's rules given in (2). The rules in (3) would state that a sentence (S) or a noun-phrase (NP) can consist of a conjunction (C) of two or more sentences (Sx) or noun-phrases (NPx), respectively. Rule 4 would represent the hypothesis that nouns can have cases like verbs (Stockwell *et al.*'s version of a proposal made in Chomsky 1967) :

(3) (a) S --> C Sx

(b) NP --> C NPx

(4) N --> N (O) (D) (A) (I) (...)

(cp. Stockwell *et al.*, vol. I, II)

As Goldin points out following Fillmore, a grammar of the type given in (2) "allows us to provide identical deep structures for certain sentences with the same meaning and the same lexical items, but whose surface subjects and objects are different; for example, sentences 4-6

4 John broke the window with a hammer

5 A hammer broke the window

6 The window broke

What is common to all three of these sentences is the verb *broke*, and one noun phrase, *the window*. The semantic relationship of *break* to *window* in all three is presumably the same, yet *window* is the object of *break* in 4 and 5, but the subject in 6. The relation of *break* to *hammer* is the same in 4 and 5, but *hammer* is the subject of 5 and the object of a preposition in 4. Case grammar allows us to state that *window* is in the Objective case in all three sentences and that *hammer* is in the Instrumental case in both 4 and 5. *John*, in 4, is in the Agentive case" (Goldin, 6).

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It is easy to think of examples of conjoined sentences and noun-phrases. Here, I would merely illustrate rule (4) with examples from Stockwell et al. (1968, 34 and 25) given in (5) :

(5) (a) John's (= Agentive) proposal (= Noun) of marriage (= Objective) to Mary (= Dative).
(b) the bleating (= Noun) of the sheep (= Agentive).
(c) the frightening (= Noun) of the sheep (= Dative).

In the rest of the thesis, however, I shall generally represent structures such as those illustrated in (5) as S's because, as already pointed out, I have no original arguments to present for or against the 'lexicalist' hypothesis adopted by Stockwell et al. in connection with structure like (5).

To sum up, the basic hypotheses underlying Fillmore's constituent-structure component are the following :

(a) The subject-of and object-of relations are considered to be surface structure relations.
(b) The basic deep structure relations are case relations.
(c) Chomsky's and others' proposed configurational definition of deep structure relations is rejected in favour of a system which directly labels the arguments of predicates.
(d) Ideally, case theory defines the correlations between (a) and (b) by means of transformations.

(e) Until these transformations can be stated, the correlations between observable semantic facts (statable by means of cases) and grammatical facts (such as subject, object, and preposition selection) provide the linguist with arguments for upholding his analyses; this, I suggest, is the most interesting aspect of Fillmore's proposals, and throughout my semantic discussion I shall try to present arguments based on such correlations, even when I attempt to go BEYOND Fillmore's framework.

3.1.3. Lexical entries.

The disagreements and uncertainties about the form and place of the lexicon in TG theories of language are well-known. A full discussion of them would require an extremely difficult study which - to my knowledge - has never been attempted, and which will not be attempted here. Similar disagreements exist among linguists working within the theoretical framework set up by Fillmore. For the present purposes, I would simply mention a few proposals made by Fillmore himself. As he does, I wish to mention them as merely examples from which "some suggestions can be gleaned for the design of canonical representations in a lexicon" (Fillmore 1969a, 133). As long as such canonical representations are not available, there can be no question of defining fully explicit lexical insertability conditions - in the sense of lexical insertion as inherited from Chomsky 1965. This qualification should be borne in mind when, following Fillmore, I speak of "lexical entries" in this section.

Before presenting an example of Fillmore's 'lexical entries', however, a few things need to be mentioned. Fillmore assumes that "most of the 'content words' in a language can be characterized in the lexicon in terms of their use as predicates", according to the format inherited from logic : PREDICATE (Argument, Argument, ...) He adds : "I take this to be true of nouns, verbs, adjectives, most adverbs, and also a great many conjunctions" (op. cit., 114). In the paper under review, however, he is especially concerned with verbs. The following are examples given by Fillmore of other categories which he would treat as predicates he does not attempt to incorporate these into his case theory - except in one instance (which is in contradiction with the general statement just quoted : KNIFE)

(6) Conjunction

BECAUSE (x, y)

(loc. cit., only example)

(7) Nouns.

BACHELOR (x) (op. cit., 123)

KNIFE

"use : I of [V O I A]

where V is 'cut', with the presupposition that O is a physical object" (loc. cit.)

(8) Adjectives.

GOOD (x, ...) (op. cit., 124)

Another point which needs to be made is that Fillmore deals with lexical entries in their 'everyday' meaning and that he does not attempt to define other uses of the words he analyzes : for instance, although he has been much concerned with 'verbs of judging', he has never discussed the legal sense of ACCUSE, and other related verbs. The following table (9) may serve to summarize his treatment of the predicate ACCUSE. As already noted, the new case label (Goal) which he introduces corresponds partly to his former Dative. Furthermore, the predicate JULGE, which enters into the definition of others is left unanalyzed both in the paper under review and in the paper on "Verbs of Judging" (Fillmore 1969b).

Lastly, let us note Fillmore's basic distinction between meaning and presupposition, both of which need to be included in lexical entries :

> Sentences in natural language are used for asking questions, giving commands, making assertions, expressing feelings, etc. (...) We may identify the presuppositions of a sentence as those conditions which must be satisfied before the sentence can be used in any of the functions just mentioned (Fillmore 1969a, 120). Fillmore (1969b, 96) regards some presuppositions as "really preconditions" for the use of sentences, thus suggesting a logical primacy of presuppositinn.

As an example, Fillmore gives the sentence *Please open the door* and he proposes the following test to detect the presuppositional aspect of its semantic structure :

> The test that the existence and specificity of a door and its being in a closed state make up the *presuppositions* [of the sentence] rather than part of its *meaning* is that under negation the sentence is used to give quite different instructions, yet the presuppositional conditions are unaffected (*loc. cit.*).

In the positive as well as in the negative version of the sentence (*Please don't open the door*), the presuppositions remain the same :

> The presuppositions about the existence and specificity of the door relate to the use of the indefinite article (...) The presupposition about the closed state of the door is a property of the verb OPEN (*op. cit.*, 121).

(9) *Lexical entry for ACCUSE*

BASIC DISTINCTIONS		SYMBOLIZATION	COMMENTS AND EXAMPLES
Arguments		x, y, z	These correspond to "specific roles" corresponding to *accuser*, *person accused*, and *offense*, respectively.
DEEP Str.	*Cases*	Source and Agent = *x* Goal = *y* Object = *z*	Cases are abstractions from these roles (*op.cit.*, 115). The subcategorization of verbs in this fashion is Fillmore's method for connecting the constituent-structure rules and the lexicon in his theory. The array of cases associated with a verb is called a case-frame feature.

SURFACE str.	Prepositions (obligatory or optional)	by with x Ø with y of with z	By will show up in passive sentences, for instance.
	Normal subject Direct object	x y	This holds for active sentences
ZEROING	Zero for indefinite	x	We say, 'John was accused' in order to be "non-committal about the identity of the accuser" (cp. 'by someone': op. cit., 119).
	Zero for definite	z	Fillmore would say that 'They accused John' "is usable only in a context in which the addressee is in a position to know" what John was accused of (op. cit.).
	Incorporation	y	In the sentence 'Ils se contentaient d'accuser' (? 'They just accused') "the nature of y is taken as part of the predicate word" (op. cit., 120).
	Presuppositions	x and y are human z is an activity which need not have taken place, and a serious offense x judges (z is 'bad')	Cp. I criticized John for murdering Jim. x I criticized John, who has never left Ohio, for taking part in the Berkeley riots.
	Meaning	x indicates (y caused z)	This characterization can be described as a "meaning postulate" (cp. G. Lakoff, 1970b).

I wish to end this brief presentation of Fillmore's proposals for lexical entries with a few comments. First, as appears from the above table, and as Fillmore (1970b) has emphasized, his way of talking of "presuppositions associated with individual lexical items" is to be regarded as an abbreviation for "presupposed belief conditions for the appropriate use of sentences containing the items in question". This position, it seems to me, is very close to - if not identical with - George Lakoff's conception of "relative grammaticality" and of linguistic theory as a device that pairs sentence representations with their "presuppositions about the nature of the world" or "beliefs about the world" (George Lakoff 1969b, for discussion, see my paper : J. Noël 1971). As far as I can see, the concept of pragmatic competence developed in Part I of this study, and the assumed primacy of presupposition are in full agreement with both Fillmore's recent pronouncement and Lakoff's conception. As will be seen presently, the central place granted in this part of my thesis to asymmetric conjunction and my proposal to reduce presupposition to a linguistic representation of asymmetric conjunction (in Ch. 3.4.) are also intended to meet preoccupations similar to those of Fillmore and George Lakoff in their recent thinking.

Second, there is some overlap in Fillmore's theory between the constituent structure subcomponent and the presuppositional aspects of the lexicon. Thus, animateness is both part of the axiomatic definitions of some cases (and crucial in distinguishing between certain cases, such as Agentive and Instrumental) and part of the presuppositional characterization of some predicates : compare, for instance, 'x and y are human' in the above table, and the need to say that 'x is animate' about x in, say, 'x is sleeping'.

Third, and most importantly, let us note that, in Fillmore's theory, the many crucial tasks which a handful of constituent-structure rules are unable to perform are left over to the lexicon. In particular, let us mention : the task of stating which cases are associated (obligatorily or optionally) with which V's or N's; the conditions under which certain items can be zeroed; the statement of meaning-postulates and presuppositions; perhaps even the setting up of a complete inventory of cases. In fact, it is as though Fillmore felt that the most urgent need in semantics is "for fresh empirical evidence obtained by painstaking study of concrete lexical data" (Weinreich 1966, 473). This is essentially the position I shall hold in this thesis, with the important qualification that I shall attempt to reduce what Fillmore would call lexical presupposition to a form of deep structure representation of asymmetric conjunction inspired by case grammar, and that I shall do this chiefly on the basis of lexical and grammatical facts attested in the Janaske corpus.

3.1.4. Conjunction, discourse, and relative clauses : problems of identity.

In this section, I wish to go beyond "the elementary structure of the "propositional" core of simple sentences" and to review some recent as well as earlier work on sentence conjunction and relative clauses. I wish to argue that the three phenomena under consideration raise a general problem of identity. First, I shall briefly mention the earlier TG treatments of sentence conjunction in order to show in what way they have been deficient and unrevealing from the point of view of semantic representation. I shall do this by first referring to Stockwell et al. whose "Integration of Transformational Theories on English Syntax" can be regarded as reflecting the state of the art in 1968. I shall also quote what I believe to be characteristic passages from a paper by Kuroda (1968) on relative clauses, as well as interesting observations made by Ross (1967) on conjunction and relative clause formation. I shall then turn to more recent treatments of sentence conjunction, namely those of Zellig Harris and Robin Lakoff, and to some relatable work by Langendoen and Lyons.

"We know nothing about conjunction". This recent pronouncement by Fillmore (1970b) is, I think, fundamentally correct; this will be apparent from the highly tentative nature of Z. Harris's and R. Lakoff's proposals as reviewed below, however novel and interesting these proposals may be. One clear indication of our ignorance about conjunction is that, to my knowledge, no one has ever seriously discussed the question of the insertability conditions for and or other conjunctions : Stockwell et al., for instance, just assign the features + CONJ and + AND to "and" (Stockwell et al. 1968, 967) in their lexicon.

In spite of Katz and Fodor's hypothesis that "the sentence break in discourse is simply *and*-conjunction" or "the appropriate sentential connective" (Katz and Fodor 1964, 490-1), and in spite of the existence in various studies of a phrase-structure rule *S --> C S x* for conjoining sentences (PS rule 1 in Stockwell *et al.* 1968, 30; cp. Langendoen 1969, 33) the problems of discourse have until recently never been recognized as a legitimate pursuit in TG research. Stockwell *et al.*, for instance, point out from the outset that they have not attempted to deal with "discourse (sentence connecting) adverbs such as *however*, *for*, *so*, *then*, *consequently*, etc." (*op. cit.*, 29).

Perhaps one of the reasons for this attitude (next to theoretical reasons of the type mentioned below in Kuroda's words) is the one which Bever and Ross invoke in an unpublished paper on discourse. I am quoting from a lecture by Labov at the 1970 Linguistic Institute. Bever and Ross are said to argue that the problem of discourse analysis is *linguistically* insoluble. They argue, for instance, that an encyclopedia would be required to establish the relation between '*the Bible*' and '*Deuteronomy*' in the following pair of sentences : "You should read *the Bible*. *Deuteronomy* is one of the ten great books of the world". The concept of pragmatic competence was developed in Part I of this thesis as an alternative to the kind of conception adopted by Ross and Bever in their paper.: in pragmatic competence, the relation between *the Bible* and *Deuteronomy* is the same as that between, say, *fruit* and *apples* ("logical inclusion": Leech 1969, 34-35).

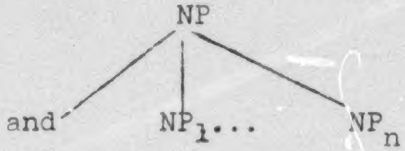
To return to Stockwell _et al._, they are mainly concerned with certain aspects of _and_ conjunction in fairly simple sentences, and they do not attempt to explore any of the semantic problems of conjunction, as the following "survey of problems" suggests:

> We are concerned here with what has traditionally been called "coordinating" conjunction. Our primary concern is with structures containing _and_, but we also attempt to give an account of structures containing _but_ or _or_. In particular, we shall investigate the structure of sentences like the following, especially (1.a-g) (which must, however, be regarded as a representative sample rather than an exhaustive summary of types) :
>
> (1) (a) John is in the house and Mary is at school.
> (b) John and Bill left.
> (c) I gave the boy both a nickel and a dime.
> (d) I gave the boy a nickel and the girl a dime.
> (e) Emily may be, and everyone agrees that Millicent definitely looks, pregnant.
> (f) John and Mary sang and danced respectively.
> (g) Julian ate pears, Jill peaches, and Jake papayas.
>
> (2) (a) (Either) John is playing basketball or his brother is jumping on the roof.
> (b) (Either) Jonathan or David played the harp.
> (c) I'll give (either) a nickel to the boy or a dime to the girl.
>
> (3) (a) Algernon went home but Nathaniel stayed.
> (b) I gave the boy a nickel but the girl a dime.
>
> In recent treatments of conjunction by generative grammarians, attention has been focused on two major questions : (1) Is there a deep-structure relationship between conjoined sentences (such as (1a)) and other conjoined structures ? (2) If there is such a relationship how many distinct devices (sets of rules or rule schemata) are required to derive these other conjoined structures from conjoined sentences ?
>
> Relevant to the first question is the choice between two possible sources for sentences such as (1.b). First, we might wish to generate the conjoined structure (_John and Bill_) in this sentence by means of a phrase structure rule like :

(4) NP --> and NP NPx

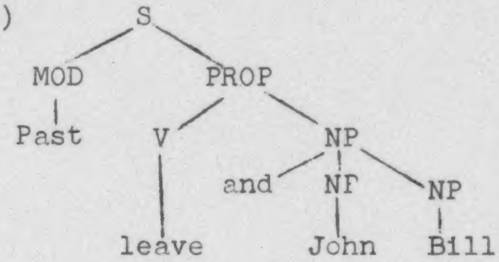
where (4) represents an infinite schema generating, in the first instance, structure like :

(5)


NP
and
NP$_1$...
NP$_n$

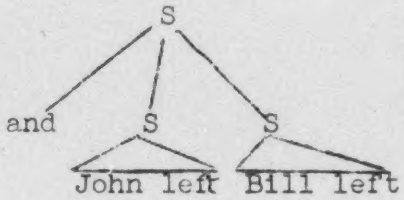
This approach, known as "phrasal conjunction, would provide for (1.b) a deep structure something like :

(6)


S
MOD
PROP
Past
V
NP
and
NP
NP
leave
John
Bill

Alternatively, we might wish to say that the deep structure underlying (1.b) comes from the rule generating coordinate sentences in the base (PS Rule 1), and is, roughly :

(7)


S
and
S
S
John left
Bill left

Where a deep structure such as (7) is modified to produce a surface form such as (1.b), we shall call this process "derived conjunction". (The process has also been called "conjunction reduction".)(Stockwell et al. 1968, 321-3).

Stockwell et al. argue that "derived conjunction" underlies essentially all conjunctions of non-sentences (ibid., 324).

Another typical attitude in the earlier TG approaches to conjunction can be seen in a pronouncement by Kuroda (1968, 1969 reprint). Kuroda notes that there are "semantic arguments" for relating discourses (such as '*something lay on the table. It was the tissue*') to relative clauses (such as '*what lay on the table was the tissue*'), but adds that "there would be no room in the present theoretical scheme of generative syntax of sentences to say that certain sentences are derived from certain discourses" (Kuroda, *op. cit.*, 280).

The only notable exception to this attitude (in the literature available to me that was published before Stockwell *et al.*) is to be found in Ross's thesis (1967). He defines a "*coordinate structure constraint*" which blocks relativization on a single conjunct in a coordinate structure : "In a coordinate structure, no conjunct may be moved, nor may any element contained in a conjunct be moved out of that conjunct" (*op.cit.*, 4.84,161). Thus, you cannot move *madrigals* out of *Henry plays the lute and sings madrigals* to form the sentence with a relative clause *x The madrigals which Henry plays the lute and sings sound lousy* (op. cit., 160). Ross then makes the *semantically* relevant observation that there are certain exceptions to his coordinate structure constraint. He considers the sentence '*I went to the store and bought some whisky*', and points out that relativization of '*whisky*' is possible only if '*bought some whisky*' has a purposive relationship to the preceding clause as in '*I went to the store to buy some whisky*' : cp. '*Here's the whisky which I went to the store and bought*' and '*x Here's the whisky which I went to the store and Mike bought*' (*op. cit.*, 168-9). Ross's conjecture is that "such sentences do not contain coordinate structures at the time when questions, relative clauses etc. are formed, but only are converted into coordinate structures later, or that they never contain coordinate structures at all". In fact, Ross concludes, "I know of no other test for coordinate structure than the one provided by the coordinate structure constraint" (*op. cit.*, 170-1).

In (10) (d), I give the only clear example which I have found in the Janaske corpus of a sentence where Ross's test shows that what we have may be no true coordination. Since the sentence in (d) is very complex, I also provide invented examples (a-c) which are similar to (d). I believe that (b) and (c) are acceptable sentences and instances of elements relativized out of the conjuncts of (a) I believe that the attested example given in (d) is parallel to (c)

(10)

(a) The farmer shot the deer with a gun *and* skinned the animal with a knife.

(b) The gun *and* the knife with which the farmer shot the deer *and* skinned it ...

(c) Using a gun *and* a knife the farmer was able to shoot the deer *and* skin it.

(d) Using the (...) International System of Notation of Organic Compounds (...), a modified IBM 026 Card Punch with document writing feature *and* an IBM 866 electric typewriter, it is now possible to assign to each organic compound a single, mathematically unique group of descriptors, *and* to punch these into a card *and* retrieve the original cipher in typewritten form at the rate of 600 characters per minute (J 273).

I am acquainted with only two major studies on conjunction since Stockwell *et al.* and Ross's thesis appeared. One is to be found in Harris 1968 and the other is Robin Lakoff 1969 (1970 version). There are interesting similarities as well as differences between these two, presumably independent, studies. In the ensuing review, I wish to suggest that work along the lines of these two studies could put an end to the ignorance about conjunction which Fillmore deplores.

The following points may serve to sum up Harris's hypotheses on "conjunctional sequences", i.e. sequences of the form $\underline{S_1\ C\ S_2}$ (Harris 1968, 131-134, except when specified otherwise) :

(i) Harris shows that conjunctions (C's) impose "certain restrictions on word sequence". These restrictions "come after those due to sentencehood and before those due to discourse". Harris also regards these restrictions as "intermediate also in character between the other two". In brief, let us say that sentencehood is defined by string theory and extensions of it such as the transformations, and that Harris regards these as operations on sets of sentences which create other sets of sentences that preserve the degree of acceptability of those of the first set : thus, an ambiguous sentence of the type Frost reads well will be transformationally related to two distinct and equally acceptable sentence types such as Frost tried to read well and One can read Frost well (op. cit., 59 and 55). While he grants that "each discourse can be rewritten as one long sentence", Harris argues that the restrictions due to discourse are "restrictions beyond those that are imposed by its component sentences". He describes them as "certain factors of modification which operate on segments of the first sentence to produce segments of the later sentences" (op. cit., 149); as far as I can understand him, this happens typically when some segment in one sentence gets repeated in a later sentence of a text, but co-occurs with material not equivalent to material present in the earlier sentence or sentence. Harris contrasts this "two-dimensional structure" of discourse with the one-dimensional, linear structure SCS ... CS (loc. cit.) under discussion here.

This is how Harris further qualifies the possibility of reducing discourses (texts) to a conjunction of their sentences by and or by some other appropriate connective (as Katz and Fodor would put it) :

> The fact that each discourse can be rewritten as one long sentence, if in no other way than by inserting the and of logic between the successive sentences (or, if necessary, between paraphrastic transforms of them) might make one think that the restrictions due to C suffice to account for the restrictions due to discourse. However, this and introduces few if any restrictions, and (...) the restrictions due to discourse are further ones (op. cit., 131).

(ii) In his treatment of conjunction Harris does not concentrate on the differences between conjunctions (e.g. but, because, and, unless), since he is primarily interested in stating general constraints which C imposes on the conjoined sentences.

(iii) The first constraint ("minimal difference") is "that certain conjunctions occur between two sentences only if there is at least a particular minimal difference between these" : cp. ' * He will write it or he will write it', 'He will write it or she will write it', 'He will write it or he will type it'.

(iv) The second restriction imposed by conjunction is called "word repetition". He establishes this by showing that adding one CS or more that introduce word repetitions raises the acceptability of an SCS sequence : for instance, the "acceptability" of 'The war will start unless he enters the room' is raised in 'Since the invaders threaten war unless the Prince of Cambodia comes to their conference room, the war will start unless he enters the room'.

(v) When a sequence having no word repetition is found acceptable - for instance, The opposition will go underground when the war starts - and when adding a further segment that brings in word repetition - for instance, because open opposition is impossible in wartime - just maintains the acceptability, Harris argues that the added segments "have the special property of being known statements of the dictionary or grammar, or of being common knowledge". He further suggests that any CS "which adds no information is zeroable" : for instance, the non-repetitive segments go underground/open.... impossible in the above example. Later in his book, Harris posits a category of metalinguistic sentences to cover all the sentences that "could be reconstructed by the receiver who understands" a given sentence (op. cit., 165-6).

Unlike Harris, Robin Lakoff 1969 is partly concerned with certain differences between the conjunctions she deals with : essentially and, or and but. Here, however, I shall discuss the main points of her paper around what she has to say about and. The main points I wish to mention about her treatment are the following :

(i) Like Harris, Robin Lakoff argues that conjoined sentences can be ranked in a "hierarchy of acceptability" (op. cit., 2). Robin Lakoff uses the term 'presupposition' in the broad sense of knowledge assumed or presupposed by a given sentence (cp. George Lakoff 1969b and others), and the term 'deduction' in the informal sense of inferences based on such presuppositions. Both her notions of presupposition and deduction correspond to Harris's notion of "common knowledge" (Harris 1968, 134). Robin Lakoff argues that the degrees of acceptability of conjoined sentences are a matter of presuppositions and deductions : "certain ones, she says, are universal, or at least assumed to be wide spread within a culture; others are confined to a subclass, or are idiosyncratic with the speaker" (op. cit., 55). Thus, in the sentence 'Felix is a cat and he has four paws' the first part involves "presuppositions arising from knowledge of the world" "that make the second part empty".

The oddity of '*John has a Ph. D. in linguistics and he can read and write*' is presumably a matter of more specialized knowledge: " to say of someone that he has a Ph. D. involves a chain of deduction, part of which contains the idea that he has completed a course of study, therefore, presumably, has been forced to do reading and writing as a prerequisite for earning the degree" (*op. cit.*, 15). Like in the preceding sentence about '*Felix*' , the second conjunct is part of the presuppositions associated with the first. In other words, the second conjunct is tautological like that in ** John is rich and he has 80 million dollars* (*op. cit.*,5). Among the sentences which require "even more specialized knowledge" to be fully acceptable - knowledge of Chinese cuisine, *and*, for a non-American, of American life - Robin Lakoff also discusses '*John wants to make Peking Duck, and I know that A and P is having a sale on hoisin sauce*'. In this connection, she makes the interesting point that such a sentence is *ambiguous* in a sense so far not discussed in the literature : its ambiguity is a matter of what "the hearer" knows about the relationship between Peking Duck and hoisin sauce. Robin Lakoff suggests to describe this ambiguity as "*situational* or *contextual*, as opposed to structural ambiguity" (*op. cit.*, 9 and footnote 2). Her concept of contextual ambiguity is the only theoretical concept I have found in the linguistic literature that corresponds to the multiplicity of metalanguages as discussed in Part I of this thesis.

(ii) With respect to (i), the *differences* between Harris and Robin Lakoff can be explained as follows. Harris proposes the single 'grammatical' and *one-dimensional* mechanism of adding *CS*'s that may or may not increase the acceptability of a given string of conjoined sentences. To understand better what Robin Lakoff proposes, one needs to remember the conception of 'grammar' (linguistic theory) put forward by George Lakoff : "a grammar characterizes the relation between surface forms [surface structures], logical forms [semantic representations], and classes of contexts [essentially, presuppositions and deductions] by generating an infinite class of pairs of derivations [relating semantic representations and surface structures] and classes of contexts" (George Lakoff 1971, 14). Corresponding to this conception is Robin Lakoff's suggestion that what belongs to the presuppositions and deductions associated with a sentence should be separated from the actual ('structural') semantic representation - as will appear from examples given below in (iii). Moreover, Robin Lakoff recognizes explicitly that there are LOGICAL mechanisms involved in what makes conjoined sentences acceptable. This is particularly clear when she discusses the sentence George likes Peking Duck, but who wouldn't ? :"the rhetorical question who wouldn't ? really means everyone does" and this, she points out, suggests that 'George' of the first conjunct must be "logically included" in everyone of the second (op. cit., 39-40). Similarly, Robin Lakoff suggests that the very odd sentence 'Six men can fit in the back seat of a Ford and I wrote my grandmother a letter yesterday' may be interpretable because "the generic comes first" and establishes "a true-for-all-time condition for the causation of the second, punctual conjunct". It is then interpretable on the basis of a set of assumptions or presuppositions, like the following : "I made a bet sometime previous to yesterday that, if six men could fit in the back of a Ford, I would write my grandmother a letter. It was duly proved that six men can do this, so yesterday I did what I promised". (op. cit., 21). Harris, as far as I can see, does not recognize, or allow for the possibility of recognizing, the logical nature of such facts.

(iii) "For all conjunction, a common topic is necessary. This may be overtly present in the superficial structure of the sentence, or may be derivable by more or less complex combinations of presuppositions + deductions. In any event, to account for the kinds of superficial structures that are amenable to conjunction, we need to incorporate the concepts of presuppositions in our grammar" (*op. cit.*, 55). Here, the *logico-semantic* notion of "common topic" corresponds to Harris's word-repetition constraint and *CS*'s having the form of definitions representing "common knowledge". What Robin Lakoff describes as common topic is best explained by means of a few examples. Robin Lakoff begins by noting that "usually" the common topic is NOT "overtly present and identifiable in the sentences"; in fact, when this is the case "conjunction reduction or gapping" usually occurs, deleting the identical constituents and reducing a sentence *John eats apples and John eats pears* to *John eats apples and pears* (op. cit., 6, 5 and 2). In most cases, "the hearer must supply, from his experience or knowledge of the world, or from prior discourse he has participated in, additional facts that link something in one conjunct to something in the second" (*op. cit.*, 6-7), and this is done by making presuppositions and performing deductions. Consider the sentence already quoted above : '*John wants to make Peking Duck, and I know that the A and P is having a sale on hoisin sauce*'. At another place, she insists that the common topic is "based on semantic rather than on purely lexical similarity" (*op. cit.*, 28) - a view which is apparently in opposition with Harris's account in terms of "word repetition". One of the set of presuppositions given by Robin Lakoff for the right-hand conjunct of the sentence about Peking Duck is :

1. (presupposition :) Hoisin sauce is the usual accompaniment to Peking Duck.
2. If there is a sale, it is a good opportunity to buy what is on sale.
3. Therefore, now would be a good time to make Peking Duck.
4. To make Peking Duck = to make Peking Duck.

In connection with this - in particular 4 - she speaks of "deduced identity" as the basis for the identity of topic in the conjuncts. The difference with Harris may not be as clear-cut as may seem at first - except for the appeal to logic in R. Lakoff's discussion. Note that the above analysis could be coverted into an *SCS* sequence creating word repetition, as Harris would suggest. For instance :

> *John* wants to make *Peking Duck*, and I know that the A and P is a store and is having *a sale* on *hoisin sauce*; and, since *Hoisin sauce* is the usual accompaniment to *Peking Duck* and since *a sale* is a good opportunity to buy *what is on sale*, now would be a good opportunity for *John* to buy *hoisin sauce* and to make *Peking Duck*, etc.

Irrespective of the validity of the details of both analyses, however, it seems to me that Robin Lakoff's insistence on the *logical* character of presuppositions and deductions (for instance, some inclusion relation holding between John's situation and what is 'usually' done) is a necessary ingredient of the analysis of conjunction, and one which Harris fails to capture.

(iv) Unlike Harris, R. Lakoff makes no difference between sentences and discourses. At one place she calls the following a "discourse" (*op. cit.*, 22) and at other places "a sentence" :

(11)

> Well, the story is as follows : The police came in, and everyone swallowed their cigarettes, and Bill choked on his, and they had to take him to the hospital, and his mother just about went frantic when she heard, and I had to placate her by lending her my copy of *Portnoy's Complaint*.

(v) At various places, Robin Lakoff traces a very tentative but most interesting connection between some uses of conjunction and Ross's hypothesis about implicit performatives (Ross 1970). For instance, she notes that the sentence with *but* given in (a) can be paraphrased as in (b) - under the assumption that '*George is a linguist*' and that '*Peking Duck is Chinese food*' :

(a) George likes Peking Duck, but all linguists are fond of Chinese food.

(b) *I say to you that* George likes Peking Duck, but *I really don't have to say this*, because all linguists are fond of Chinese food. (*op. cit.*, 39 and 42).

(vi) The logical nature of the common topic constraint appears most clearly in the distinction which - unlike Harris - R. Lakoff makes between *symmetric* and *asymmetric* conjunction.

Symmetric conjunction can be characterized by the fact that it is reversible without any change in meaning : '*Fred is chasing the aardvark and Mary is eating toast*'. But like in the asymmetric type, "a common topic is necessary if the conjunction is to be acceptable" (*op. cit.*, 24). For '*John has a yacht and Bill has a lovely home in Scarsdale*', for instance, a possible presupposition one might regard as the common topic is "Owning a yacht is an example of conspicuous consumption, and having a lovely home in Scarsdale is too" (*op. cit.*, 25).

Asymmetric '*and*' is "equivalent to *and then*, in either a temporal or a causal sense" while symmetric *and* simply links two or more sentences without imposing an order of priority on the sentences it links. The discourse of (11) is an example of the asymmetric type. With this type of *and*, R. Lakoff argues, "the first member of the pair is presupposed for the second to be meaningful" (*op. cit.*, 22).

If one attempts to object to (10) by saying '*But the police never came in*', "the result is bizarre, and renders the whole discourse somehow nonsensical" (*op. cit.*, 22). Moreover, the sentence '*Everyone swallowed their cigarettes and the police came into the room*' is either a "symmetric conjunction, or it makes very different assumptions about causality than does" '*The police came into the room and everyone swallowed their cigarettes*' (*op. cit.*, 20). In asymmetric conjunction, "the whole is, in a sense, greater than the sum of its parts : besides the stringing together of a number of facts (the sum of its parts), the whole also includes the idea that each one led up to the next, and that one would not have occurred, or would not be true, except that the ones that preceded it were true. Taken out of context, the conjuncts would not retain this causal or implicational link so that part of the meaning of the sentence would be lost". (*op. cit.*, 23). Robin Lakoff conjectures that with asymmetric conjunction "it is the two conjoined sentences as wholes that participate in the relationship" marked by *and*, and that the common topic is "the causality or temporal priority" (*op. cit.*, 26).

Obviously, Robin Lakoff's pronouncement that "taken out of context" part of the meaning of the conjoined sentences would be lost needs some qualifications as I shall try to show later. This can already be seen if we examine one of R. Lakoff's examples just quoted : *I had to placate her*, for instance, necessarily presupposes that the female person in question is *excited*, *frantic*, or the like, this holds irrespective of the context and can be regarded as something that has to do with *placate*, *need placating* ,etc. This is a lexical presupposition, of the type discussed by Fillmore. To quote one of Fillmore's clearest examples (Fillmore 1968c, 52) the fact of stating in isolation a sentence with borrow does not affect its presuppositional meaning. Compare (12) (a) and (b) :

(12)

(a) John had a book and Bill borrowed it from him.
(b) Bill borrowed a book from John.

(12)(b) carries the presupposition that John had a book (before the time of borrowing) whether or not this sentence is uttered before (b) and conjoined with it. Or, to take another example, if somebody concludes that such and such is the case, we need not be told that something came before and that the one who draws the conclusion bases it on that previous event. Similarly, when somebody answers somebody else something must necessarily have been said before the answering. In fact, with verbs such as borrow, conclude, buy/sell, agree (not to mention adverbs like again) it is particularly obvious that the very notion of a simple sentence in isolation just collapses. Lexicographers show awareness of this in their examples: for instance, I asked him to help me and he agreed (Hornby's entry for agree : Hornby 1963). What this goes to show is that statements of identity will have to incorporate facts of the type discussed by Fillmore around the concept of presupposition. My arguments here are similar to (unfortunately still informal) proposals put forward by some logicians. Thus, in an attempt to reconcile the atomistic position of the semantic approaches based on Chomsky with the holistic positions of structural semanticists, Gochet 1970a puts forward a notion of "double context", after a suggestion made by Rivetti Barbo to distinguish between the context provided by the sentence, and the context provided by the lexicon. Reference would be based on the former and sense on the latter. As Gochet points out, 'sentence context' can be responsible for semantic redundancy (as in The bird flies) or *selection* (as in *He drank the stuff*) but never for a *qualitative change* in meaning. Gochet also quotes Rivetti Barbo who writes : "if meaning were to depend on the context provided by the sentence, it would be impossible to understand new sentences that have never been heard before" (Gochet 1970a ,229-230).

(vi) As a tentative conclusion to her discussion on *and* R. Lakoff advances the following hypothesis. She notes that 'A and B are both examples of conspicuous consumption' allows the further deduction, 'A and B are similar' (i.e. a sentence with a symmetric predicate, which can take any number of conjuncts, as in *Bill, John and Harry are similar*) whereas asymmetric conjunction can be reduced to a sentence with an asymmetric predicate such as *A follows B* (*≠ B follows A*; *x A follows B follows C*). "Then, perhaps, what one means by symmetric conjunction, and common topic in connection with it, is 'possibility of reduction by presupposition and deduction to an underlying symmetric predicate', opposed by asymmetric conjunction involving reduction to an asymmetric predicate" (*op.cit.*, 27).

Neither Harris nor Robin Lakoff include the question of *relative* clauses in their discussions of conjunction. I believe this to be regrettable and will try to fill the gap here on the basis of some of Langendoen's work. The reasons for discussing conjunction and relative clauses together are, I think, fairly obvious. For one thing, there exist paraphrase relations between many conjoined sentences and sentences with relative clauses. These have been mentioned above in connection with a paper by Kuroda and have led Annear Thompson and Langendoen (among others) to posit that sentences with relative clauses are transformationally derived from conjoined sentences.

But an even more important reason for linking the two problems is that for both types of structures it is necessary to state that some identity holds between constituents in two or more sentences. Thus, in all the traditional accounts of relative clause formation based on Chomsky's formulations an identity condition needs to be stated between an NP in the matrix sentence and an NP in the embedded sentence in order to transform the phrase-marker into a sentence with a relative clause : for instance, the identity involving the man in "the man (the man had been fired) returned to work" (cp. Chomsky 1965, 137 and 145). The same is true of the Annear Thompson proposals to derive sentences with a relative clause by means of optional transformations from pairs of conjoined sentences (Annear Thompson 1970a and b; Langendoen 1970, 141-5).

Now, as Langendoen has shown, the identity problem appears in a new light in conjoined sentences or in discourses as soon as one considers the effect of what he calls projection. Thus, in The whale swallowed Jonah "the argument the whale receives the specification SWALLOWED JONAH and Jonah, SWALLOWED BY THE WHALE", and, in a discourse, the following sentence is incompatible with the first : However, Jonah managed to escape being swallowed (Langendoen 1967, 105). If this is correct, as I believe it is, at least part of the identities in discourses will have to be stated in a form closely related to that of relative clauses, as in The whale swallowed Jonah but Jonah (who had been) SWALLOWED BY THE WHALE escaped. The problem is also related to that of pronouns (he instead of Jonah) and deictics (for instance, the man for Jonah). Thus, it seems to me that projection would have to be taken into account in rules of relative clause formation - including Langendoen's own formulation of these rules.

To close this review of what I believe to be important contributions to the study of conjunctions, it is necessary to refer again briefly to Lyons's work on implication and hyponymy (Lyons 1968, 453-5). Lyons suggests that a sentence '_I bought some flowers_' implies EITHER a 'disjunction' '_I bought some tulips OR I bought some roses OR I bought some violets..._' OR conjunctions '_I bought some roses AND some tulips_', OR '_I bought some violets AND some tulips_', etc. This could no doubt be extended to other parts-of-speech categories than nouns, as appears from many dictionary definitions : for instance _mean_ 'low, bad, unkind, OR dishonest in small ways', _fetch_ 'go to another place AND bring a thing from it' (West 1965). I shall return to these questions later. Here I would merely say this : no matter how problematic Lyons's account of implication may be, it suggests that his concept of implication is part of the broader problem of conjunction between sentences, and of the identity which Harris and Robin Lakoff posit to hold between conjoined sentences.

To conclude, the following points may be made; the underlying assumptions and claims will be examined in chapter 3.3.

(i) Harris and Robin Lakoff have suggested that sentence conjunction imposes some kind of identity constraint on the conjoined sentences : "word repetition" or zeroable _CS_'s expressing "common knowledge", according to Harris, and a "common topic" based on "presupposition" and "deduction" according to R. Lakoff.

(ii) If we follow R. Lakoff's suggestion, presupposition and deduction have certain _logical_ properties which need to be formulated in a linguistic theory.

(iii) R. Lakoff's distinction between _symmetric_ and _asymmetric_ conjunction is an important one. In particular, it raises the problem of whether _asymmetric_ AND is basic or derived, and of how to state its relations with superficially distinct items - for instance, conjunctions of purpose (Ross 1967, 168-9), asymmetric verbs such as *cause*, *follow*, etc.

(iv) The following point is implicit in (iii) as well as in Harris's contention that intersentence *and* in discourse is "logical" *and*. It seems that one essential value of asymmetric *and*, as compared to other predicates, is that it blurs, obscures or neutralizes relations which are made explicit by other predicates or by various other linguistic means (such as time adverbials). This can be shown in various ways . Jespersen, for instance, made similar observations in his discussions of nexus-substantives and rank-shifting ;compare the following :

(13)

Sentences with nexus-substantives	Sentences connected with *and*, etc.
(a) The Doctor's extremely quick ARRIVAL AND uncommonly careful EXAMINATION of the patient *BROUGHT ABOUT* her very speedy RECOVERY.	(a') The Doctor ARRIVED extremely quickly *AND* EXAMINED the patient very carefully; she RECOVERED very speedily.
(b) Close upon his RESIGNATION *FOLLOWED* his last illness and death	(b') He RESIGNED *AND* shortly after he BECAME ILL *AND* DIED [my paraphrase]

(Jespersen 1965, 137-8)

A similar situation has been illustrated as follows in a recent study of "interclausal relations" in a Philippine language (Inibaloi) :

> Suppose, for example, a situation in which John leaves the apartment and goes downtown exactly seven minutes by the clock before Mary, his wife, comes home. John may report this event the next day in the words, 'I went downtown and Mary came home'. If he chooses this wording, he disavows interest in temporal considerations. On the other hand, John may find himself in a situation where it is of crucial importance to establish the succession of events. He may therefore say, 'I went downtown and then Mary came home'. In still other circumstances John may want to emphasize that the two events were not far apart and that succession between them is of no importance. In this case he may say 'About the time I went downtown Mary came home'(...) This analysis of John's three ways of reporting the same situation does not reduce the distinctive conjunctions to synonyms, but preserves their essentially different thrust, while at the same time it recognizes the option of the speaker to conceptualize the same situation differently. (Ballard *et al.*, 1971, 72).

(v) A further question which arises from the studies reviewed above concerns the relations between *conjoined sentences*, *texts* or *discourses* and relative clauses. In particular it is necessary to test the hypotheses about the possibility of reducing all discourses or texts to a conjunction of their sentences by *and* or some other appropriate connective, and to compare these hypotheses with the Annear-Langendoen proposals about relative clause formation, and Langendoen's notion of projection.

(vi) It may be necessary to examine facts of the type discussed by Fillmore around his notion of presupposition and of the type discussed by Lyons around implication and hyponymy to capture some aspects of the identity problem in sentence conjunction and relatable constructions.

(vii) It seems that R. Lakoff accepts the derived conjunction hypothesis about noun-phrase conjunction (and presumably verb-phrase conjunction) for instances of symmetric conjunction.

It remains to be seen whether the hypothesis can apply to asymmetric conjunction.

(viii) Lastly, let us mention the problem of relating the implicit performative hypothesis with the Harris/Lakoff hypotheses about conjunction.

3.2. 'A DISCUSSION OF ...'

3.2.1.1. Articulate sentences : active.

In this chapter, I wish to examine sentences of the type 'The author discusses -', and relatable constructions, such as 'A discussion of-' as they stand, for instance, at the beginning of an abstract. Following Jespersen (1965, 308), I shall distinguish between "articulate sentences" ("I thank you"), "semi-articulate sentences" ("Thank you") and "inarticulate sentences" ("Thanks"). Among the articulate sentences, I shall discuss successively active constructions (in this section, and the next : 3.2.1.2.) and passive constructions (in 3.2.2.). Semi-articulate and inarticulate sentences will be dealt with in section 3.2.3. My inventory of the expressions examined in this chapter is based on the assumption that they convey no information about the subject or topic of the abstract in which they appear but rather serve to introduce this topic. The purpose of what follows is to examine on what theoretical foundations such a working hypothesis could be based.

The following points will not be discussed, in spite of their possible interest :

(i) The problem of tenses. The most frequent tense is the present, as in 'The author discusses-'. Following Zandvoort, it may be called a "neutral present", "used when no particular time is thought of" (Zandvoort 1966, 59). Occurrences of the present perfect are far less frequent : "The authors have included -" (J 975). So is the preterit, as in "On the basis of these experiments we concluded that-" (J 150).

(ii) Various problems which could perhaps be dealt with by means of transformations. Compare : "A world-wide survey..." (J 103) and "A survey of the world-wide..."(J 992).

(iii) References to the reader of the abstracts . I found only a few examples, as in "...may guide the interested reader" (J 705), "In the second chapter the authors give us-"(J 38).

(iv) The question of 'implicit performatives'. Following Harris (1968, 79 f) and Ross (1970), all declarative sentences can be analyzed as object clauses depending on a declarative main verb : e.g. 'I declare to you that -'. In the abstracts under investigation, the I would stand for the abstractor, or for the author in the case of an author's abstract. In the Janaske corpus, I have found a small number of sentences which may require reference to the implicit performative hypothesis - although I have no idea of how to explain them. Some are passive sentences, which are discussed below (3.2.2.). The others are essentially expressions which reflect the abstractor's opinion about what he reports. Consider the underlined words in the following sentences, in particular some adjectives and adverbs :

(1)

(a) Of special interest is chapter 6 (...) which is concerned with - (J 524).

(b) Of particular interest is the lucid description of - (J 687).

(c) The presentation is in tabular form which offers easy comparison of - (J 499).

(d) The engineer has been joined in the search by physicists, biologists, neurologists, psychologists, and linguists, not to mention mathematicians. (J 258).

(e) The interesting observation is made that - (J 507).

(f) Included are extensive tables (...) and a generous list of references vital to seemingly every aspect of this field (J 715).

(g) Contends that... To make a comment on these comments, ... (J 1104).

(v) *Expressions for 'AUTHOR' and 'TEXT'*. I shall also ignore the problems concerning what can stand in the place of 'author' and 'paper' in sentences of the type 'In this *paper* (the *author*) discusses -'. In the Janaske corpus, I have found that what may be referred to as the 'AUTHOR' role can be played not only by words like '*author*' or '*writer*', but also by the name of the person in question (e.g. 'Dr. So-and-So') or by noun-phrases referring to the person's function : for instance, "The president of Stanford Research Institute discusses- " (J 149). The 'TEXT' role can be played by various words as are listed in (2). The words of the (a) list have as a determiner either the demonstrative *this*, or *the* (*present*) with a demonstrative value. Very often, this role is played by just the demonstrative pronoun *this* (c) as in "*This reviews-*" (J 2).

(2) 'TEXT'

(a) 'WHOLE'

article
bibliography
book
compilation
dictionary
discussion
edition
glossary
issue
letter
manual
material
narrative
note
(these pages)
publication
report
review
study
survey
volume

(b) 'PART'

appendix
bibliography
chapter
glossary
part
photographs
supplement
talk
..

(c) DEICTIC ONLY

this

Here I shall not discuss these various points in order to concentrate on two questions : I shall delineate a case analysis of sentences of the type 'The author discusses - '; and examine the possibility of relating some of the sentence types under discussion to each other by means of rules of implication.

Following Fillmore, I shall argue that "the subject relation is a result of neutralization of other deeper grammatical relations" (Hofmann 1969, 12) and I shall attempt to determine what these deeper grammatical relations could be in the active sentences under discussion in this section. "The ideal technique" for doing this "is to find a systematic pairing of sentences which are paraphrases and which contain the same lexical items, in such a way that one of each pair has one nominal (or "NP") as subject while the other has another nominal subject" (loc. cit.). Applying this technique, we observe that in active sentences, the verb 'discuss' can have two clearly distinct types of subjects, which can be called 'AUTHOR' and 'TEXT' respectively. Moreover, when 'AUTHOR' is the subject, 'TEXT' can be used in prepositional phrases introduced by in. Compare (3) (a), (b), and (c) :

(3)

(a) The author discusses ——

(b) This paper discusses ——

(c) In this paper, the author discusses ——

It would be worth investigating to what extent various words other than those listed in (3) behave like 'paper' in (3) : 'grammar', 'novel', 'rule', 'signpost', tomb-stone, etc.

Extending the observations made in (3) to the whole of the Janaske corpus Icame up with a fairly large list of verbs all appearing in active sentences; this list is given in (4). Whatever the semantic as well as syntactic differences between these verbs may be, I suggest that they all accept the three types of constructions just illustrated above in (3) with 'discuss'. The verbs which were actually found as accepting both 'AUTHOR' and 'TEXT' as subject are underlined in list (4) :

(4)

'AUTHOR' or 'TEXT' or 'THIS' AS SUBJECT

adds that
admits that
advocates
argues that
analyzes
asserts that
assumes that
begins with
cautions against
cites
characterizes -as-
chronicles
claim
compares
is concerned with
concludes that/with
conclusion is that
considers NP/that
contends that
covers
criticizes
deals with
defines
demonstrates
details
describes
develops (X)
devises (x)
discusses
(re)emphasizes
ends with
estimates that
evaluates
explains

mentions
names
notes
offers
outlines
points out that/NP
points up
predicts
presents
provides
proposes that/Ving
recognizes that
recommends
recounts NP
refers the reader to
refers to
reflects
reports
reports on
reviews
sees..as
shows
states that/-to + V
stresses (the fact) that
suggests
summarizes
surveys
tells of
touches (up)on
traces (history)
treats
turns to
unearth
urges that/-to + V
views

explores
favors
forecasts
gives (us)
illustrates
includes
indicates that /NP
insists that
lists
warns against/that
writes that

(X) "The author develops a communication system..." (J 606).
(x) "The paper devises a method for ..." (J 908).

The verbs of the above list can now be opposed to other attested verbs (or cognate expressions) that have a different syntactic behaviour : some seem to accept ONLY 'AUTHOR' AS SUBJECT (5), and others ONLY 'TEXT' OR 'THIS' (6). In addition, I have found one expression with 'TEXT' as prepositional phrase: "— is the subject of this paper" (J 622) (cp. 'The subject of this paper is —': not attested).

(5)

ONLY 'AUTHOR' AS SUBJECT

(a) believes
    is convinced of/that
    feels that
    is hopeful that
    lives with
    is of opinion that
    is pleased with
    is satisfied with

(b) it became clear to — that

(c) —'s belief is that
    —'s concern is with

(6)

ONLY 'TEXT' or 'THIS' AS SUBJECT

(a) amounts to
    is concentrated on
    contains
    is designed to
    is devoted to
    is divided into (-parts:)
    is in (-parts)
    is like nothing so much as

is limited to
occupies (pp...)
is on
relates to

(b) is an account of
is an analysis of
is an appeal to (-to V)
is an attempt to
is a bibliography
is a (reference) book for
is a description of
is a dictionary of
is a discussion of
is an evaluation of
is an examination of
is an explanation of
is an exploration of
is a guide to
is an illustration of
is a list of
is a note on
is an outline of
is a plea for/to (-to V)
is a report on/of
is a review of
is a study of
is a summary of
is a survey of

In what follows I shall concentrate on just a few verbs around the following points :

(i) A Locative analysis of 'TEXT';
(ii) An Experiencer analysis of 'AUTHOR';
(iii) Arguments for a topic case;
(iv) Prepositions as predicates versus 'essive' analyses.

(i) A Locative analysis of 'TEXT'.

The strongest argument for a Locative analysis of 'TEXT' in sentences with verbs such as 'discuss' (list 4) is the following. If Fillmore is correct in assigning the locative case to the expressions underlined in (7) (a), then those underlined in (7) (b) must also be analyzed as locative :

(7)

	(a)	(b)
(i)	"IT is windy in Chicago".	"IT says in the Bible (that)..." (Jespersen 1966, 238; Zandvoort 1966, 59; not in Janaske).
(ii)	"Chicago is windy". (Fillmore 1968a, 25)	This paper discusses —
(iii)		In this paper, the author discusses—

Besides, I have no attested examples of passives like the following : 'x is discussed by this paper', 'x has been included by the paper'. In addition, an examination of the Janaske corpus shows that both in the active sentences discussed here and in the passive sentences to be discussed in section 3.2.2., only the preposition 'in' shows up, next to clearly locative adverbs in the passive constructions: "— is HERE presented" (J 486), "— are reported HEREIN" (J 298). The only exception which I have found may be attributed to special properties of the verb guide : "The description is rather short, but the reader is guided to more detailed information on the subject through the bibliography provided with the article" (J 928 : the 'with' is presumably to be regarded as a comitative rather than an instrumental 'with').

The only other case that oould serve to analyze 'TEXT' is presumably the Instrumental case. This hypothesis, however, must be rejected for two reasons. First, the possibly instrumental expressions which are associated in the Janaske corpus with verbs such as 'discuss' are different from 'paper', etc.: "On the premise that— the writer discusses —" (J 289), "In addition to defining — by using a simple illustration of—, the author shows—" (J 82), "The concept of quantity is used to describe the statistical correlation ..." (J 76; cp. 'x The article is used to describe').

Second, there is one range of examples in which the Instrumental analysis contrasts with the Locative one. These are sentences with verb such as 'prove', 'show', 'indicate', 'suggest', etc. to which Fillmore 1970b would assign an Instrumental case. Thus Fillmore would, I think rightly, analyze the first that-clause as an Instrumental in "That Harry is still living with his mother PROVES that he is a bad marriage risk" (Fillmore 1969a, 121), which could be simplified into "This PROVES that—". Now, note that "This PROVES that——", has a different meaning if 'this' refers to some 'TEXT' as in 'This paper proves that—'. The following, similar examples are drawn from the Janaske corpus; I suggest to interpret 'this' as a Locative in (a), and 'they' as an Instrument in (b); and that a similar contrast is present in (9) :

(8)

(a) A discussion and evaluation of the suggestion by — for "A Concise Form for Scientific Literature Citations". The suggestion centers around the use of four letters for the title of each journal. This suggests that the confusion resulting from the use of these abbreviations may exceed any possible benefits from the space saved. (J 372).

(b) While many of the findings are still of a preliminary nature, they show the need for further development... (J 690).

(9)

(a) Neither method TELLS much about scientists' use of current literature (J 1051).

(b) The authors TELL how the procedures and cards (...) would be changed if they were to start again (J 671).

(c) The article TELLS of the techniques and devices under investigation (J 1063).

I can only think of verbs such as 'illustrate' and 'exemplify' with which the contrast between the Instrumental and the Locative analysis is not clear, as in the following sentences :

(10)

(a) A chart illustrates this problem.
(b) The author uses a chart to illustrate this problem.
(c) The author illustrates this problem with a chart.
(d) The problem is illustrated in a chart.

I am unable to provide evidence for or against a locative analysis of 'TEXT' with verbs of list (5) : 'believe', etc. I found no such evidence in the Janaske corpus and I had no chance of checking my intuitions about these verbs with native speakers. To take just 'believe' and 'belief', it seems to me that 'In this article, the author believes that—' is possible, that 'This article believes that—' might be found acceptable by some speakers, but that 'The paper's belief is that—' is impossible.

(11) An Experiencer analysis of 'AUTHOR'

In sentences with the verbs or cognate expressions of list (5) - such as 'believe' or 'belief' - Fillmore would assign 'AUTHOR' the Dative case (1968a, 24), which he now calls Experiencer (1969a, 116). The first basis for distinguishing between Agent and Experiencer is conceptual : it is expressed in Fillmore's definition of these cases. However, I can see two other reasons for an Experiencer analysis of the subject of 'believe', etc. One is that, irrespective of details which I have been unable to establish, the verbs of list (5) do not seem to accept Locatives as subjects as easily as do those of list (4). Another difference is that verbs like 'believe' do not accept manner adverbials such as 'briefly' '*concisely*', '*carefully*', '*verbally*', '*in detail*', etc. : 'x The author believes briefly that—'.

(iii) *Arguments for a Topic case.*

The following sentences suggest that the notion of topic must somehow be associated with at least some of the verbs under discussion. Indeed, *some* way must be found to predict the occurrence of the words underlined in the following sentences :

(11)

(a) covers such *areas* as ... (J 587)
(b) covers the following *topics* (J 584)
(c) emphasizing *matters* ... such as ... (J 715)
(d) the *subject* of ... is described (J 829)
(e) guides to *subject fields* such as (J 912)
(f) information on the *subject* (J 928)

The question is whether a new case is the appropriate way of capturing such facts. An alternative solution would be to regard the topic label as a presupposition, which could be attached to the argument of the verbs in the fashion proposed by Fillmore 1969a : for instance, '*x discusses y*' for '*y is a topic*'. Another solution, of the type suggested in Langendoen 1970 (78), would be to subcategorize another case such as the Object case ("the most neutral case") by means of the topic case : "Object : Topic ". I would object to both solutions on the following grounds. Such a subcategorization as well as presuppositions always serve to state restrictions : for instance, the fact that *x* must be 'human' in a sentence with ACCUSE. But, with verbs like '*discuss*' what is needed is on the contrary something very neutral and general, since there is no conceivable limit to be imposed on the type of things which can be '*described*', '*discussed*', etc.

Furthermore, I can think of no better characterization than a Topic case for the x in the following sentences :

(12)

(a) x is the subject of this paper.
(b) The subject of this paper is x.
(c) This paper is on x.
(d) This paper is about x.
(e) This paper concerns x.

I would agree with George Lakoff in regarding 'be about' and 'concern' as "two-place relations, whose arguments are a description of a proposition or discourse and the item which is the topic of that proposition or discourse" (G. Lakoff 1969c, 30) and, within case theory, I see no better way of capturing this fact than by labelling the x of sentences such as those of (12) as a Topic case.

If this is oorrect, the question arises whether such an analysis can be extended to at least some verbs with sentential objects : particularly, verbs of list (4) like 'explain', 'say', 'state', 'tell'. An argument in favour of such an extension is the following : sentences of the type 'He discusses x' (or 'His paper is about x') and of the type 'He says that ...' are BOTH equally appropriate answers to such questions as 'What is the subject of his paper', or 'What does he talk (write) about ?', or 'What is his paper about ?'. Furthermore, 'He says something', etc. is an uninformative answer to such questions. In section 3.2.3., I shall return to this point and elaborate upon this argument on the basis of evidence found in the Janaske corpus.

The same extension of the Topic analysis to predicates of list(5) is, I think, to be rejected on the following grounds: in answer to the above questions it is always possible to say, '*He says that he believes that—*', but hardly, '*He believes that he says that—*'. In other words, I would say that like '*discuss*' and other similar verbs, verbs like '*say*' introduce a Topic, whereas verbs like '*believe*' are part of the Topic. The same kind of test could serve to establish whether verbs of list (4) are of the same type as '*discuss*' or not . *Question* : 'What does he talk about ?' *Answer* : '* He says that he discusses—', '* He says that he states that—', etc. versus 'He says that he warns against—'.

(iv) *Prepositions as predicates versus 'essive' analyses*.

There is currently much hesitation in TG studies on how to treat prepositions. To take just one example, Langendoen hesitates between adopting Fillmore's *essive* proposal (for *N is N* sentences : Fillmore 1968) and the representation of prepositions as predicates, and he mentions sentences such as 'A is in B' = 'B contains A', 'A is about B'= 'A concerns B', 'A is by B = 'B wrote (composed) A' among the "problems and suggestions for further study" (Langendoen 1970, 99). Also consider the following asymmetries

(13)

(a) The text is on *x*
(a') The text discusses *x*
(b) * The author is on *x*
(b') The author discusses *x*
(c) In the text, the author discusses *x*
(c') ? In the text, (it) is on (or: concerns) *x*
(c'') ? In this story, it's about *x*.

A further problem is the existence of 'there is' and 'there are' next to 'be'. Compare the following :

(14)

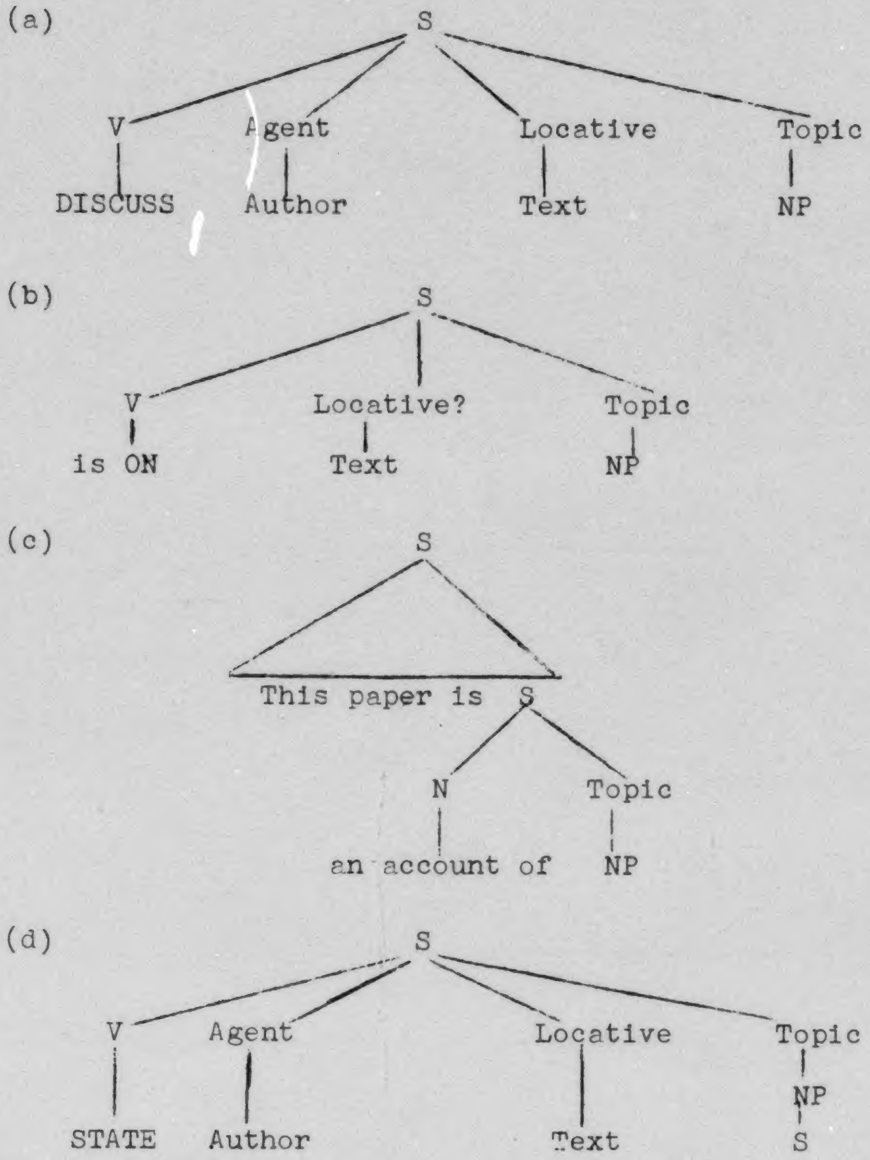
(a) This paper is an account of--
(a') In this paper there is an account of--
(b) This book is in three chapters.
(b')This book contains three chapters.
(b'') There are three chapters in this book.

Note that (14) (b'') is different from 'There are many toys in the box' which was analyzed in Fillmore 1968a (456): it seems to me that 'three chapters' are part of 'this book' in a way in which the 'toys' are not part of the 'box'. Note moreover that 'is on' does not behave like 'is in': corresponding to 'is on' there is no sentence with 'there is/are' like (14) (b''). This in fact may be regarded as an argument in favour of the analysis of 'is on' as a predicate like 'concern'.

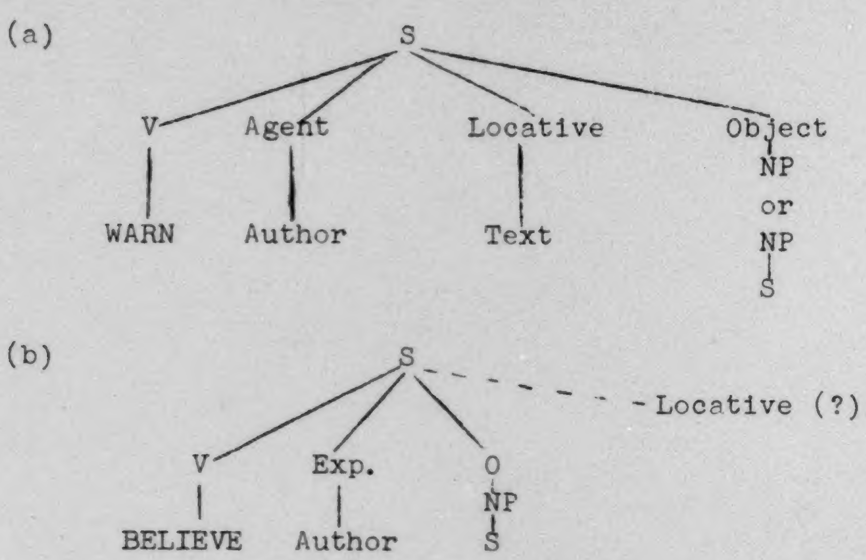
In the absence of more reliable knowledge about the questions dealt with in this paragraph, I shall not attempt to propose an analysis for sentences of the type illustrated above in (14). I would merely suggest that I see no objection to analyzing 'an account of—' and similar nominals in sentences like (14) (a) and (a') as N + Topic (cp. Stockwell et al.'s PS rule 7).

To sum up, I would propose that the verbs under discussion fall into the following broad types; in (c), I write S for what Stockwell et al. 1968 represent as N.

(15)


(a)
S
V
Agent
Locative
Topic
DISCUSS
Author
Text
NP
(b)
S
V
Locative?
Topic
is ON
Text
NP
(c)
S
This paper is S
N
Topic
an account of
NP
(d)
S
V
Agent
Locative
Topic
STATE
Author
Text
NP
S

(16)



On the basis of such representations, I suggest that rules could be written that make use of the *implication* relation (Lyons and Leech) or of Katz's and others' similar *entailment* relation. First of all, such rules would state that a bilateral implication relation holds between sentences with '*discuss*' (etc.), '*is on*' (etc.) and '*... is an account of*', irrespective of whether TEXT or AUTHOR is selected as the subject of '*discuss*' and similar verbs. Secondly, implication rules could also be set up to state, for instance, that a sentence such as '*The author explains that a system has be designed...*' imply '*The author discusses a system which has been designed...*' . I shall not go into the detailed formulation of such rules, because it seems to me that they present a serious problem for case theory. Indeed, I would hypothesize that such rules would have to say that, for instance, '*x explains that S*' implies that '*x discusses z*', where *z* is what is selected as *subject* of S, no matter what case it is. Lastly, if following

Leech we can say that 'John is madly in love with Susan' implies deductively 'John is in love with Susan' (Leech 1969, 36) we can say similarly that sentences like the following imply that, for instance, 'The author discusses x' : 'The paper describes x in some detail', 'The writer describes x in terms of Boolean algebra', etc.

3.2.1.2. Articulate sentences : active.

So far I have dealt with expressions which are fairly simple in their surface form. However, the Janaske corpus contains many expressions, the complexity of which is even more beyond the powers of any theoretical framework known to me than those discussed in 3.2.1.1. And yet, these expressions are intuitively relatable to those of the type 'the author/the paper discusses—'. Three of these expressions are quoted below, in (17) :

(17)

(a) This book fills the need for a text in the way of a general introduction to the subject of — (J 575).

(b) The purpose of this paper is to remove some of the mysteries surrounding— and to show — (J 696).

(c) The inclusion of— represents an attempt to fill at least in part the existing gap (J 281).

Less complex expressions attested in the Janaske corpus can be mentioned here, in the form of the following table (18). Needless to say that not all the combinations generated by this table are attested or even possible. To take just one examples, "Sixteen authors contributed their views on" is attested (J 449), whereas "the paper attempts to contribute a plea for" is not and may perhaps be found unacceptable by some speakers. Still, I have to resort to a tabular presentation in order to avoid having to quote the hundreds of examples on which my tables is based.

Besides I have left out various attested or possible expressions which would need to be characterized by even more specific co-occurrence requirements than those which I have ignored in the following table : for instance, "hold goals/ ideas for", lay/place emphasis/stress on", "report a sampling of", "develop the thesis that", "call attention to", "take pains to", "take issue with", "discuss the general picture of", "express belief/confidence that", "reach/point to the conclusion that", "set forth considerations involved in","draw/bring out conclusions", etc.

(18)

SUBJECT POSITION OR RELATABLE POSITION		VERBS OR COGNATE NOMINALS IN OBJECT POSITION OR IN A RELATABLE POSITION.
Subjects	Corresponding Predicates	
Only 'AUTHOR' as subject	appends elaborates with (?)	account of analys- appeal- compar- defin- demonstrat- descri-(ption/bing) determ- discern- discuss- evaluat- examin- exampl- expla-(nation/ining) explor- facts about idea(s) illustrat- list- notes on mention of observ- outlin- a paradigm for a plea for (the following) points : report-
Only 'TEXT' or 'THIS' as subject	is followed by is prefaced by	
	is addressed to (Ving) is an attempt to is designed to is devoted to is an effort to is intended to/as	
	consists of contains covers (?) is included	
'AUTHOR' or 'TEXT' (or 'THIS') as subject or as genitive of nominals	begins with concludes with ends with (cp. terminate text)	
	aims at aim is to attempts to goal is to purpose is to seeks to tries to	
	includes	

	±	contribut- furnish- giv- mak- offer- present- provid- show-	review- sampl- show- stat- study- summar- supplement- survey- views on

It seems to me that within the limits of current theories - particularly case theory - the following points can be made here in connection with the above table. I shall ignore variuus details, some of which are rather mysterious : compare, for instance, "The text is prefaced by a discussion of—", and "?x The text is appended by a discussion of—".

First, the same grammatical alternatives as those noted above in connection with 'discuss', 'believe', 'is on', etc., exist for the superficially more complex expressions just tabulated - namely just AUTHOR or just TEXT or both as possible subjects. Besides there is a certain amount of semantic parallelism cutting across the various grammatical alternatives : 'succession in text' (appends, is followed by, begins with), 'purpose' (is addressed to, aims at), 'inclusion' (contains, includes). Second, it seems reasonable to posit that expressions like 'make an attempt/an effort' and 'contribute/furnish/give/present... an analysis/etc.' have the same case representation which is of the form V (Agent, Goal) - where attempt, analysis, etc. are exponents of the Goal case. Third, it also seems reasonable to extend the Agentive analysis of 'author' in 'The author discusses—' to all the expressions which require such an extension : 'The author begins with a discussion of—', 'The author attempts to discuss—', 'The author presents a discussion of—', and 'The author attempts to present a discussion of—'. Similarly, the locative analysis of 'paper' in 'The paper discusses—' and in 'In this paper, the author discusses—' could be extended to the following types of expressions :

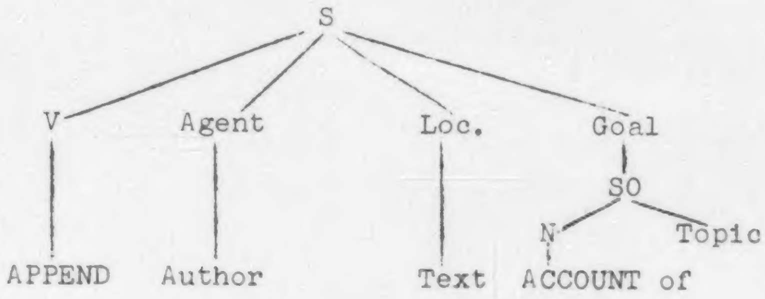
(19)

(a) In this paper, the author begins with a discussion of—
(a') This paper begins with a discussion of—
(b) In this paper, the author attempts to discuss—
(b') This paper attempts to discuss—
(c) In this paper, the author presents a discussion of—
(c') This paper presents a discussion of—
(d) In this paper, the author attempts to present a discussion of—
(d') This paper attempts to present a discussion of—

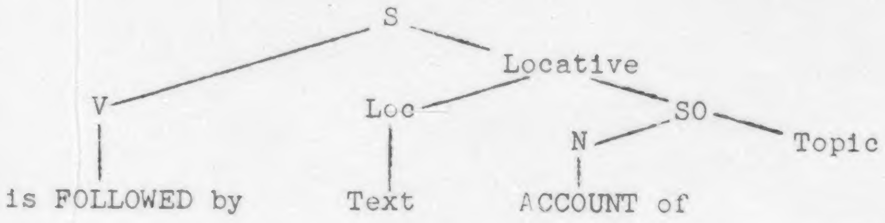
Sschematically then, I wuuld tentatively propose the following analyses :

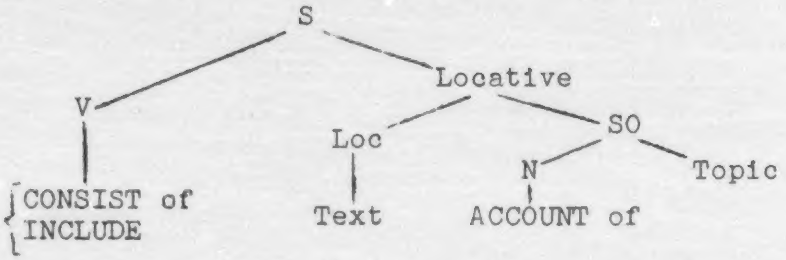
(20)

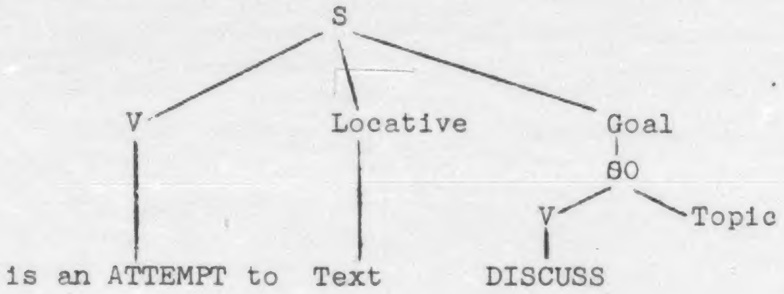
(a) Only AUTHOR as subject.


S
V
Agent
Loc.
Goal
SO
N
Topic
APPEND
Author
Text
ACCOUNT of

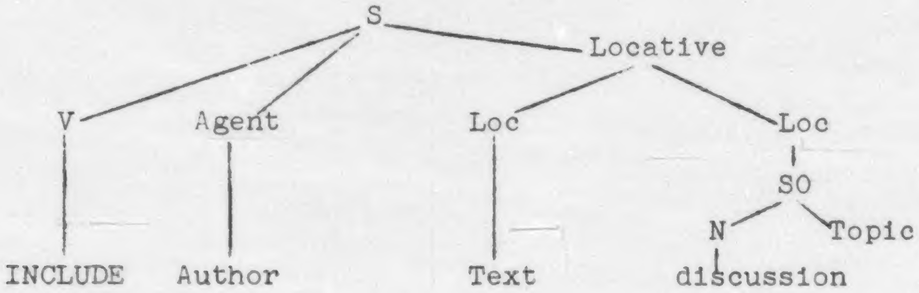
(b) Only TEXT as subject

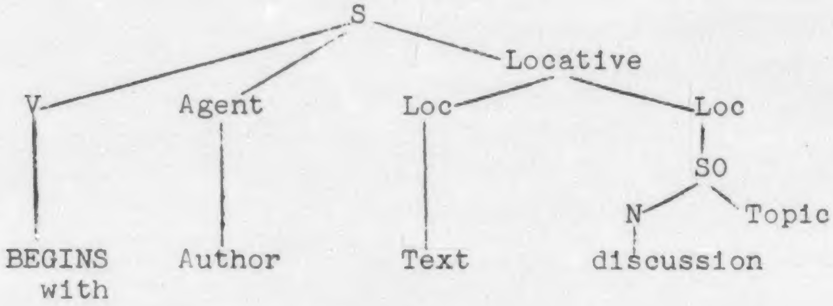

S
Locative
V
Loc
SO
N
Topic
is FOLLOWED by
Text
ACCOUNT of

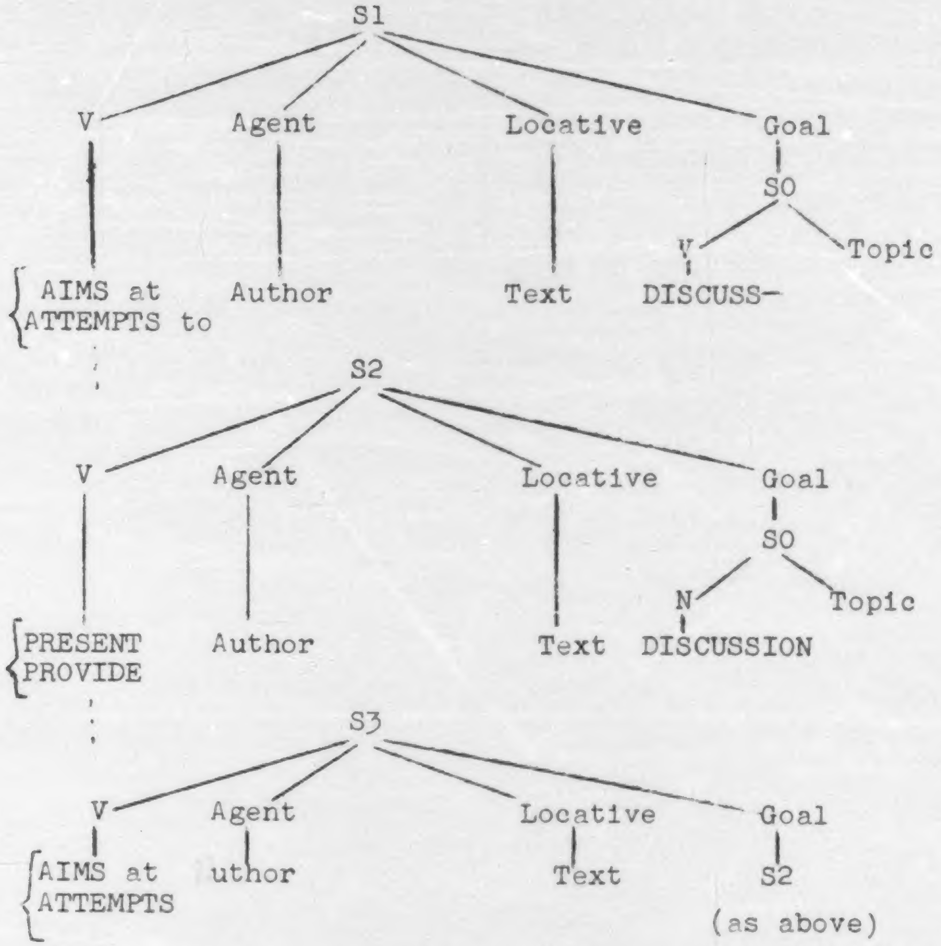

S
V
Locative
Loc
SO
N
Topic
CONSIST of
INCLUDE
Text
ACCOUNT of


S
V
Locative
Goal
SO
V
Topic
is an ATTEMPT to
Text
DISCUSS

(c) AUTHOR or TEXT as subject


S
Locative
V
Agent
Loc
Loc
SO
N
Topic
INCLUDE
Author
Text
discussion


S
Locative
V
Agent
Loc
Loc
SO
N
Topic
BEGINS with
Author
Text
discussion

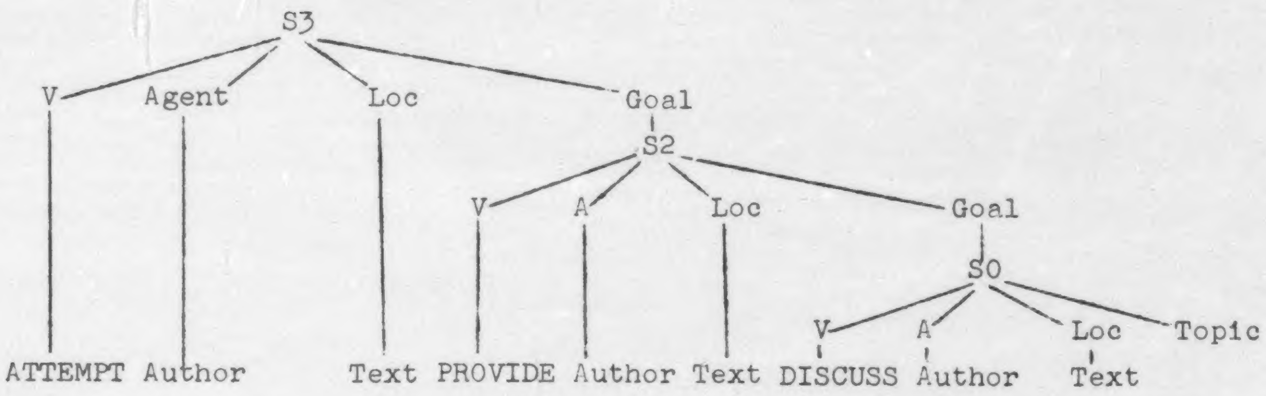

S1
V
Agent
Locative
Goal
SO
V
Topic
AIMS at
ATTEMPTS to
Author
Text
DISCUSS-
S2
V
Agent
Locative
Goal
SO
N
Topic
PRESENT
PROVIDE
Author
Text
DISCUSSION
S3
V
Agent
Locative
Goal
AIMS at
ATTEMPTS
uthor
Text
S2
(as above)

Here again, I suggest that implication rules could state, for instance, that S3 implies S1, S1 implies S3, and presumably that S1 and S3 imply S2. Similarly, all the sentences diagrammed in (20) can be said to imply SO, that is, "DISCUSS + Topic", or the like, but not vice versa.

I wish to end this section by making two further points. The first one concerns the transformation known as equi-NP deletion by which a sentence of the type 'John tries to read' is derived from a deep structure of the form 'John tries (John read)'. I have omitted various problematic details in the diagrams given in (20). Consider, for instance, a sentence of the type

I have called S3 : 'In this paper, the author attempts to provide a discussion of—'. Suppose, furthermore, that we wish to say that 'account' or 'discussion' in this sentence is actually a verb in deep structure. Under such an assumption S3 would have to be diagrammed as in (21), since the three verbs of this sentence accept both Author or Text as subject:

(21)



But note that such a representation would require four noun-phrases eligible as subject to be deleted, namely the two Authors and Texts associated with DISCUSS and PROVIDE respectively. I am not acquainted with any solution proposed for this problem in the literature. Whatever the solution may be, I shall return to some aspects of this problem in 3.2.3. : in particular, I shall argue that it is difficult to represent semi-articulate sentences such as 'Discusses—' and 'A discussion of—' (standing at the beginning of an abstract) as I have represented S0 in the above diagram. In other words, I shall argue against deriving these semi-articulate sentences from corresponding articulate sentences such as 'In this paper the author discusses—'.

My second point is perhaps relatable to the problem of ATTEMPT (to) in the above diagram. It has to do with various purposive sentences. Compare the purposive sentences of the type tabulated above in (18) (for instance, "*The specific aim of* the study *is to* discuss—" : J 1051) with those listed in the following table :

(22)

'DISCUSSION OF	S1	PURPOSE	S2
- Report of	a(premilinary) study	to	obtain some empirical data on— (J 842)
- Report of	a study by(...)	for the purpose of	determining— (J 852)
- 0	A study of(...)	for the main purpose of	analyzing— (J 879)
- A report of	a three weeks' trip.	The three aims of the trip were	1)to examine— 2)to study— 3)to control— (J 887)
- 0	This article is WRITTEN	to	help— (J 916)
- Report of	a study CONDUCTED at—	for the purpose of	examining— (J 919)
- 0	0 DESIGNED	to	acquaint— (J 920)
-	A chart is GIVEN	to	illustrate— (J 983)
-	—were examined	to	determine— (J 938)
-	Explores—	with a view to	discovering— (J 522)

I shall leave the problems raised by the first column undiscussed in the present thesis. Now, if we consider column S1 in the table, the nouns in this column are relatable to sentences. which seem to be of the type *Verb + Goal* : "make a trip", "write an article", "design/conduct a study", "give a chart". Others could be analyzed as *Verb + Topic* : "examine—", "explore—". Such data, it seems to me, raise the following question. Consider sentences of the type 'the author's *purpose is to* discuss—' (or 'The purpose of the paper is to discuss—'), and, say, 'This paper/The author attempts *to* discuss—'. The question which arises is whether the deep structure of such sentences should not be a *two-clause sentence* roughly of the form'S1 *for the purpose of* S2'.

I can think of two arguments in favour of such an alternative analysis. First, while it is possible to say "The study analyzes—", "The purpose of the trip/study is to analyze—", it is not possible to say "x The trip analyzes—". On the other hand, purposive expressions impose various other restrictions on the predicates depending on them : e.g. 'x The author's objective is to feel that—'. Second, nouns like '*paper*', '*author*', '*trip*' and the like are by no means the only grammatical category that can enter into the frame '*The purpose of*—*is to*' : for instance, "The essential purpose of *literature searching* is to locate..." (J 773). In chapter 3.4., I shall propose a (two-clause analysis for such sentences which may also be applicable to some of the examples given above in (22).

Applying this two-clause analysis to sentences like 'The purpose of the paper/author is to—' would of course require that 'paper' and 'author' in such sentences would be represented in deep structure as sentences or as cognate nominals : e.g. ('the) writing this paper' . While I have no idea of how this could be done, I feel that examples like the following make such a proposal plausible : compare "At the time of this report" (J 1) and "At the time this report was written" (J 121). The difficulty with positing deep structure sentences for surface nouns like 'paper' is that there is no known way of deciding which (set of) "appropriate" verbs would have to be posited in such sentences : 'write', 'prepare', 'publish' (this paper .), etc. (see Harris 1968, 164 f. on "appropriate words").

3.2.2. Articulate sentences : passive.

I only wish to mention briefly the following points :

(i) There are various expressions which I believe to be superficially as well as semantically too complex to be tractable and I shall not attempt to analyze them. One example is : "In addition to references dealing with— , entries have been included covering the subject of—"(J 1000).

(ii) There are a number of expressions of which it is difficult to say with certainty whether they are passive. Some examples are listed in (23). Both (23) (a) and (b) have been treated as actives in the preceding section. If the active counterpart is regarded as unacceptable ('x A brief account prefaces—', (a) cannot be regarded as a passive. Similarly, (b) sounds more natural to me than its active counterpart: ? 'A outline for — follows a discussion of—' ; I would say that the intransitive active use of 'follows' is more acceptable, as in : 'An outline for — follows, emphasizing —'. I have no explanation for such facts. Similarly, the active counterpart of (c) sounds a bit funny to me : 'In these pages the author compresses/has compressed a general review of—'.

(23)

(a) — is prefaced by a brief account of— (J 122)
(b) A discussion of — is followed by an outline for— (J 136).
(c) In these pages is compressed a general review of— (J 1007).
(d) ... the authors have included—.— are included also. (J 975).
(e) Also included are tables which indicate— (J 654).
(f) Included in the paper are : a detailed discussion of— and mention of— (J 116).
(g) In it is outlined— (J 891) .

A similar problem about deciding whether a sentence is active or passive arises with expressions such as '*is designed to*', '*is devoted to*', '*is intended to/as*' which were treated as actives in the preceding sectinn. As Fillmore once put it, "*Stative adjectives* can be derived from (...) change of state verbs" such as *break* :'*The window is broken*' can be understood either as a passive or as a description of a state. Similar sentences with other verbs, such as '*hit*' ('*The window was hit*'), can only be understood as passives. With reference to '*is designed to*', etc., I would say that such sentences are ambiguous like the sentence with '*break*' but I can think of no explanation for this fact (Fillmore 1967, 18-19).

(iii) Next to those exemplified in (23), I have found various constructions which I shall not attempt to analyze. Compare the constructions superficially similar to passives in (24) and (25) with those given in (26) and (27) respectively.

(24)

(a) Listed and annotated are— (J 826).
(b) Announced in this paper are— (J 985).
(c) Appendixed are— (J 1004).
(d) Also reported is— (J 1115).

(25)

(a) *Arising* from this study is— (J 919).
(b) * Mentioned is that—
(c) Mention is made of the fact that—
(d) The fact is mentioned that—

(26)

(a) Finally, *there is presented* an explanation of—(J 421).
(b) *There is* thus *achieved* the general description of— (J 963).

(27)

(a) *There is a very useful* supplement of— (J 38).
(b) With regard to—, *there was* a plea for— (J 525).
(c) *There is* a general examination of— and a detailed description of— (J 664).
(d) However, *there are* just as many warnings on— (J 923).
(e) *There is* a discussion of— (J 993).

(f) There is also a general estimate of—(J 1020).
(g) There are numerous illustrations and a two-page bibliography (J 1063).
(h) There is agreement with the general belief that—(J 1069).

(iv) According to Langendoen (1970, 142) "The girl (whom my cousin married) became pregnant" is derived from "My cousin married a girl. She became pregnant". Thus, a sentence such as (28) (a) would be derived from a deep structure having the form illustrated in (28) (b) - namely "a discourse consisting of two sentences":

(28)

(a) The system described employs ... (J 35).
(b) A system is described. It employs—

Langendoen (loc. cit.) claims that in the sentences quoted in (29) (a) and (b) "the temporal order" of the sentences "suggests a corresponding temporal order to the events described" : (a) "describes a situation in which a girl becomes pregnant after marriage", and (b) "a situation in which she becomes pregnant before marriage". Besides, he claims that "this semantic difference between the discourses carries over into the sentences with relative clauses" — (29) (c) and (d) respectively :

(29)

(a) My cousin married a girl. She became pregnant.
(b) A girl became pregnant. My cousin married her.
(c) The girl whom my cousin married became pregnant.
(d) My cousin married a girl who became pregnant.

Irrespective of what one may think about Langendoen's linguistic intuitions here, the fact is that no temporal order is present either in the sentences with relative clauses or in the corresponding sentences given in (30).

When such an order is present, as may be the case in some examples of (31), it seems to be entirely due to the meaning of the sentences or clauses involved, and not to the grammatical construction.

(30)

(a) A system which employs (...) is described.
(b) The system which is described employs—.
(c) The system described employs— (J 35).
(d) A system is described. The system (It) employs—.
(e) The system employs— This system is described here.

(31)

(a) The classification scheme *presented here* had its origin in... (J 33).
(b) Documentary activity will be coordinated at national level by the *proposed* Institut für Dokumentationswesen (J 47).
(c) Arising from the study is a suggested standard for abstract journals *which is also reported in this paper* (J 919).
(d) — are reported in this paper (J 1028).

(v) I shall assume that what has been said in the preceding sections about *implication* rules can hold for passive constructions, provided the suitable case analyses are available. Thus, a presumably bilateral implication relation can be said to hold between the following sentences:

(32)

(a) Efforts are devoted to exploring *x* (J 120).
(a') x is/are explored.
(b) An attempt is made to give a general picture of x (J 590).
(b') x is depicted/described.

(vi) Most of the undoubtedly passive constructions in the Janaske corpus are of the form '*—is/are mentioned*' or of a slightly more complex form such as '*Mention is made of—*'. The forms which I have found will be listed below. What is important to note here is that the great majority of these sentences *contain no mention* of 'AUTHOR' or 'TEXT'. I have found only *one* sentence in which both are mentioned (33a). One clear instance of a passive sentence containing a presumably Instrumental expression has been found (33 b), and only about twenty sentences with a locative prepositional phrase at the beginning (as in 33 c), or at the end (as in 33 d), or an adverb (as in 33 e) :

(33)

(a) — is explained *by G. Meyer* *in an article entitled—* (J 798).
(b) — are listed and assessed *in the light of—* (J 599).
(c) *In this paper*, — are described (J 680).
(d) — is dealt with *in this article* (J 789).
(e) — are reported *herein* (J 298).
(e') — is *here* presented (J 486).

The verbs and verbal expressions which I have found in passive constructions in the Janaske corpus are listed below in (34) and (35). In the latter table I omit the statement of various co-occurrence restrictions which would specify, for instance, that '*emphasis*' is 'given to', 'put on', 'placed on', that '*questions*' are 'raised', 'asked', 'answered', that '*note*' is 'made', that '*comparisons*' are 'made' or 'drawn' (J 1077), that '*a belief*' is 'expressed', etc.

(34) IS/ARE :

advanced
advocated
analyzed
appended
appraised
arranged
assessed
attributed to
believed(to be)
claimed
compared to
computed
considered
covered
criticized (as)
dealt with
decried
defined as
delineated
depicted
described
detailed
determined
diagrammed
discussed
displayed
distinguished from
elaborated
emphasized
enumerated
enunciated
estimated
evaluated
examined
expected to
explained
found
given
groped for
grouped
identified
illustrated
included
indicated
investigated
justified
listed
mentioned
noted
outlined
pointed out
presented
presumed
proposed
purported to
quoted
recommended
regarded
rejected
reported
reviewed
shown (to)
sketched
stated
stressed
studied
suggested
summarized
tabulated
touched upon
traced
treated

(35)

(a) + (b) IS/ARE :

(a)

account
analysis
annotations
appeal
attempt
a catalogue
charts
comments
comparison
conclusions
considerations
data
details
description
distinction
dream
examples
estimate
evaluation
explanation
generalizations
glossary
guide lines
illustrations
indication(s)
indexes
information
list
observation
plans
proposals
recommandations
(general) remarks
report
resume
review
samples
statistics
suggestions
survey
synopsis
table(s)

(b)

added
advanced
appended
drawn
given
included
made
offered
presented
provided
outlined
submitted
summarized
supplied

I suggest that the subject of passive sentences with at least some of the verbs listed in (34) may be analyzed as the Topic. For the expressions listed in (35), what I propose to describe as a possible Topic has the grammatical form of a prepositional phrase depending on the subject head noun : for instance, x in 'an account of x is given', or in 'an account is given of x'

In the rest of this section, I shall be concerned with a problem which can be stated in the form of the following paradox. As will be remembered, 'AUTHOR' and 'TEXT' are mostly not mentioned in the passive constructions under discussion; on the other hand, it seems that 'AUTHOR' and 'TEXT' are conceptually present under the influence of the context, but that it would be a mistake to posit them in deep structure. This suggests that passive constructions such as 'x is discussed' would be relatable not to the corresponding active sentences ('In this paper, the author discusses x') but rather to semi-articulate sentences of the type dealt with in the next section (3.2.3.) : 'A discussion of x', and 'Discusses x'. They would have a deep structure of the form Predicate + Topic. Now, Fillmore suggests that sentences like 'The arrow hit' are instances of "definite" pronominalization. He argues that 'The arrow hit' and 'The arrow hit IT' are paraphrases and that in both, "the speaker expects the identity of the 'target' (Goal) to be already known by the addressee". Moreover, he proposes that such facts should be represented in the lexical entries, as idiosyncratic properties of predicates such as 'hit'. The following is, I think, a strong argument against such a conception as far as the passive sentences under discussion are concerned. When 'AUTHOR' and 'TEXT' are not mentioned, you cannot refer back to them by means of IT or HE (SHE) :

(36)

(a) * x is described. *It* also describes x.
(b) * x is described. *He* (*She*) also describes x.

Moreover, such a fact cannot be regarded as an idiosyncratic property of the predicates in question, considering that 'AUTHOR' or 'TEXT' are so to speak always omitted from the passive sentences under discussion, and that this is the case with all the predicates attested. This suggests that conceptually incomplete structures of the type *Predicate + Topic* should be generated by the base of the theory (as should be Jespersen's "*Thank you*"), and that our ability to relate the corresponding sentences to their 'complete' active counterparts should be accounted for not by transformations, but by a device of an unknown nature : presumably one of the type envisaged by George Lakoff (1971), which would PAIR representations of *contexts* with representations of *sentences*. Such a device would give recognition to Jespersen's observation that

> Only bores want to express everything, but even bores find it impossible to express everything (...) in the most everyday remarks we suppress a great many things (...) "Two third Brighton return" stands for something like : "Would you please sell me two third-class tickets from London to Brighton and back again, and I will pay you the usual fare for such tickets". (Jespersen 1965, 310).

The usual absence of an Agent in the passive sentences under consideration may result in ambiguities which can often not be resolved linguistically. Moreover, the same kind of ambiguity arises with nominals (Jespersen's nexus-substantives). This happens when it is not clear whether the understood Agent of a predicate is what Jespersen calls "the generic person" or some definite person, for instance, the author of the abstracted publication (Jespersen 1966, 317). Thus, expressions such as '*It is assumed that—*' and '*the assumption that—*' can have two readings - and occasionally three -

in the passages quoted below. These readings can be paraphrased respectively as '*The author* assumes that—', and 'It is *generally/usually* assumed that—' or 'The *abstractor* assumes—'. To show how this ambiguity arises, it is necessary to quote more than one sentence. Compare the passives in (37) (a) and (c) with the nominals in (b) and (d); in both (a) and (b), it is impossible to know for certain *who* "assumes". In (c), the abstractor, the author and the "generic person" all seem to be eligible as implicit Experiencer of '*believe*'.
In (d), we may regard "the Library Association in London" as an additional possibility, presumably ruling out the abstractor (because of '*The* belief').

(37)

(a) (First sentence of the abstract; '*Author*' is the implicit Agent of '*outline*':) Plans are outlined for organization of institutes for medical statistics and documentation (...). *It is assumed* that all clinical hospital departments (...) will initiate... (J 545).

(b) (First sentence of the abstract; '*Author*' is the implicit Agent of '*discussion*', but not necessarily of '*assumption*':) A discussion of computers based on *the assumption that* they are, could, or should be considered the ultimate in information processing devices (J 619).

(c) This is a dictionary of the special meanings given to over 400 words and phrases as used by documentalists. Designed to assist those just entering the field, *it is believed that* it will also give some stability to the word usage by documentalists already in the field. (J 1058).

(d) Approach to the training of scientific information specialists as seen by the Library Association in London. *The belief* is that librarian and information officer use basically the same materials and techniques... (J 747).

Other examples of ambiguous passives are given in (38). In all these examples, the first sentence of the abstracts is quoted and is unambiguous in that 'AUTHOR' is the Agent understood from the context. For reasons which I am unable to explain, some sentences that follow the sentence with the ambiguous passive may be unambiguous, as seems to be the case in (b) and (c). Let us say that what I mean by 'context' here is the format adopted in the Janaske bibliography to present the abstracts : the name of the author, followed by the title of the abstracted publication, itself followed by the abstract (Appendix 4).

(38)

(a) A cost comparison is made between manual and mechanical selection operations in a small company (...) Costs for mechanical selection are found to be double those for manual methods, but are justified on the basis of ... (J 382).

(b) Discusses potentialities of a retrieval system (...) Capacity of system in present form is estimated at (...) Details of system are not described. (last sentence : J 238).

(c) The Delta punched card is of the Batten-Cordonier type. It is recommended in cases where ... (J 594).

(d) The first Soviet tests of machine translation were conducted in 1955 (...) It is expected that by 1961... (J 624).

(e) Reports on a technique for literature indexing (...) This "probabilistic indexing" method is said to allow (...) Finally, the results of a small-scale experiment are given and analyzed (J 640).

(f) This is a third interim report on (...) Because it is possible to describe one concept by utilizing several different verbal expressions, it was found necessary to develop one metalinguistic common denominator ... (J 707).

When there exist adverbs corresponding to the verbs under investigation, it seems that they are potentially ambiguous like the verbs in the passive. Thus, 'admittedly' can be ambiguous between 'the author admits that—', 'It is generally admitted that—' and perhaps 'the abstractor admits that—' in (39) (a); something similar seems to happen with '*consequently*' in (b) because there is not clue as to who draws the consequence, and in (c) with '*deplorably*' - perhaps because of special properties of *believe* (Langendoen 1970 on opacity : 114); in (d) and (e), however, there is no doubt as to the author been conceptually involved in '*critically*' and in '*emphatically*' for reasons that are unclear to me.

(39)

(a) States that when (...) it is time for librarians and documentalists to stop questioning the value of thesis literature and its control. The practices with respect to this body of scientific literature (...) are discussed. *Admittedly,* progress has occurred through... (J 92).

(b) The financial success of documentation activities is difficult to assess. *Consequently*, it is useful to calculate the costs... (J 57).

(c) The author believes that the standards are *deplorably* low (J 293).

(d) Discusses the question of who should prepare abstracts and indexes and examines *critically* ... (J 399).

(e) Fundamental problems of (...) are discussed (...) It is stated *emphatically* that ... (J 47).

3.2.3. Semi-articulate and inarticulate sentences.

This section is concerned with semi-articulate sentences of the type 'Discusses—' and 'A discussion of—' (I ignore the type 'Presents a discussion of—', which also exist) and with inarticulate sentences, that is, sentences consisting of just a noun-phrase ('Three representative problems of...' J 4), and, more broadly, sentences which are not introduced by 'Discusses—' and the like. I shall just mention briefly the following points :

(i) Constructions which have no status - or an unclear status - in case theory :

(40)

1. Instrumental expressions (?)
    - (a) A discussion, from actual practice, of— (J 385).
    - (b) A detailed discussion (using specific examples) of— (J 937).
    - (c) A discussion of— based on the assumption that— (J 619).
2. Point of view
    - (a) Lists— by province or state... (J 30).
    - (b) Discusses — from the point of view of ... (J 1046).
    - (c) —a view from the reference desk. A view of— from the standpoint of— (J 312).
    - (d) A comparison of— with respect to— (J 630).
3. In the form of
    - (a) ... communications in the form of comments... (J 987)
    - (b) Cp. : Data are presented in summary form (J 945).
4. Goal (?)
    - (a) An introduction for those new to... (J 717).
    - (b) Cp. The report written for laymen as well as for scientific specialists... (J 992).
    - (c) Cp. Directed to the librarian, this article ... (J 1059).
    - (d) A plea to all developing an information retrieval system (J 663).

5. *Experiencer* (?)
   The author's concept of... (J 242).
6. *Source* (Fillmore 1969a)
   ... comments *from individuals* concerning... (J 987).
7. *Agent* (cp. Stockwell *et. al.* 1968)
   (a) A statement *by Senator H. Humphrey* ... (J 1009).
   (b) Confessions *of Cleveland documentalist*... (J 497).

(ii) Some verbal forms have no cognate nominal with the same meaning and vice versa. In other cases, the grammatical constructions required by the cognate forms are different. Besides, some cognate forms can be unacceptable as such in *semi-articulate* sentences :

(41)

	Verbs	Nominals
Fully Equivalent	Lists	(A) List of
	Reports on	(A) Report on
Semantically equivalent	∅	(An) Account of
	Advocates—	∅
	Concerned with	* Concern with
	Deals with	∅
	∅	(A) directory of
	∅	An essay on
	Gives	* Gift
	∅	(A) plea for
	Shows	* Show
	Tells of/how	∅
	Traces (the history)	* Traces of
	Urges	* Urges
grammatically not equivalent	Explains that	An explanation of
	Notes that	A note on
Difference in semi-articulate sentences	Concludes that	*(A)conclusion that (cp.:the- is that)
	Conceives of	*The concept of(cp. The author's concept of)
	Observes that	*An observation that (cp.The-is made that)
	Points out that	*A point that(cp.The- is made that)
	Remarks that	*A remark that(cp.The- is made that).

The following nouns and verbs that function as main predicates in the semi-articulate sentences under investigation are given in (42) and (43). Contrary to what might be expected, those that were found in titles are the minority.

(42)

An account of
An analysis of
An appeal for
Bibliography on/at
A Collection of
Comments on
A comparison of
A compilation of
The author's concept of
A consideration of
Considerations/on/for/of/in/relating to
Confessions of
Contents :
Critique on
Description(s) of
Dictionary of
Directory of
A discussion of
A discourse a la ...on
A dissertation on
The distinction between
Documentation on
—encyclopedia
An essay on
An estimate of
An explanation of
Facts and figures on
Guide through/to
Guide lines for
Glossary of
Introduction to
Index to/of
An investigation of/into/for
List of
A listing of
A manual of
A memorandum
Material on
Notes on
Observations on
Outline of
Papers on
Plea for
A presentation of
A projection of
Proposals of
A proposal for/to
Recommendations for
Refutation
Remarks on
Report of/on
Review of
Research on
Sketch of
Study of/on
Suggestions for
Summary of/on
Survey of
Some thoughts on
A view of

(43)

Advocates
Analyzes
Annotates
Assumes
Chronicles
Comments that
Concerned with (the idea that)
Concerns
Contends that
Concludes that
Contains (chapters treating)
Covers among others such topics as
Deals with
Defines
Describes
Discusses(matters of)
Envisions
Examines
Explains
Explores
Feels that
Gives
In(four sections):
Introduces
Lists
On
Outlines
Points out
Predicts
Presents
Proposes
Provides
Recommends
Regards
Reports on
Reviews
Says
Shows
States
Stresses
Suggests
Summarizes
Surveys
Tells of/how
Urges
Views

In order to understand the purposes of the present discussion, it is necessary to remember that under the standard methodology inherited from TG approaches to syntax, surface sentences are usually derived from their most complete or explicit representations. In other words, deep structures generally represent various entities which can be left unexpressed or implicit in the surface realizations of sentences. Jespersen - who, incidentally, does not "recognize as sentences" such expressions as "book-titles", on the ground that they "occur in writing only and thus fall outside language proper" - grants that "spoken language may indulge in many suppressions" (Jespersen 1965, 311), and points out the difficulty of reconstructing some semi-articulate and inarticulate sentences : "an old-fashioned grammarian", he says, will be inclined to explain incomplete sentences "by his panacea, ellipsis". But as Jespersen notes, it is sometimes difficult to do this : "what is understood in (...) "special edition !" ? "I offer you..." or "Will you buy... ?" or "This is... "?" (op. cit., 307).

In the rest of this section, I wish to examine to what extent it is possible and justifiable to reconstruct the semi-articulate and inarticulate sentences under discussion. I shall first consider the semi-articulate type, and assume that what can be said about them is also true of the passive constructions in which 'AUTHOR' and 'TEXT' are not mentioned. Indeed, it seems to me that the expressions underlined in (44) are equivalent. Moreover, the question arises whether the titles - which I regard as inarticulate sentences - are not equivalent to the semi-articulate sentences that follow (the first sentence of the abstract) :

(44)

(a) New kinds of indexes (title)
Discusses new chemical indexes which ... (J 83).
(b) New role of machines in document retrieval...(title)
A discussion of the role of machines in ... (J 100).
(c) The case for centralized internal communications (title)
Discussion of the need for ... (J 125).
(d) Efficient use of the IBM file of ASTM powder x-ray diffraction data (title)
The use of the IBM file of powder x-ray diffraction data ... is discussed.

The technical notion of TG linguistics which is relevant here is that of (non)recoverable deletion (Katz and Postal 1964; Chomsky 1965, 144-5, 177-82). Formulated in terms of this notion, Jespersen's problem is whether or not it is possible to analyze (i.e. reconstruct) the sentences under discussion in such a way that the reconstructions meet specified conditions allowing for the derivation of these sentences by deletion rules of the so-called recoverable type.

The following passage from Levin 1971 can serve to summarize the question of recoverable deletion; note, in particular, the statement of three types of conditions under which a given deep-structure representation lends itself to deletion transformations :

> In Katz and Postal (1964, pp. 79-81) the principle was stated that only those deletion transformations should be permitted in a grammar which result in unique distortions of a Phrase Marker - in other words, only such deletions as are recoverable given the resulting P-marker and a description of the transformation involved. Katz and Postal then defined three types of formal conditions under which recoverability of deleted elements is possible and hence where deletion is permissible : (a) if the deleted element is one actually mentioned in the structure index of the transformation; (b) if the deleted element is strongly identical with another element in the same P-marker; and (c) if the deleted element is dominated in its underlying P-marker by the constituent Pro. Omitting details and simplifying, (a) is instanced in the imperative transformation, where *you* is mentioned in the structure index, (b) is instanced in reflexive and relative clause transformations, and (c) is instanced in sentences like *John is reading*, where in the underlying P-marker the NP following the verb is expanded as Pro, this in turn is realized as *something* [or *it*], and (...) subsequently deleted (...) [As Katz and Postal point out,] some such underlying form must be posited in order to explain the fact that [*John is reading*] is not infinitely ambiguous; it does not mean 'John is reading books or magazines or a tombstone, etc.' (Levin 1971, 41 and 48).

Conditions (a), (b) and (c) as formulated in the above quotation are particularly relevant here. As my additions indicate, (c) can refer either to definite pronominalization - the situation which is relevant here ('John is reading IT') - or to indefinite pronominalization ('John is reading SOMETHING') (cp. Fillmore 1969a, 119).

I shall first consider Levin's first condition. It parallels Jespersen's point about the difficulty of reconstructing some semi-articulate or inarticulate sentences and concerns the possibility of "actually mentioning" certain entities in a structure index. Taking just the example '*A discussion of—*', it is easy to realize that there is an *indefinite* number of elements that could be reconstructed in a structure index for '*A discussion of—*', and that there is no way of establishing that one reconstruction is 'better' than another. This is illustrated below in (45) :

(45)

1. *Active*.
    - (a) *There is* A DISCUSSION OF— (cp. There is a general examination of— : J 664).
    - (b) *This is* A DISCUSSION OF—
    - (c) *(In this paper/report(etc.) the author gives/presents/includes/offers/etc.* A DISCUSSION OF—
    - (d) *This paper/report/etc. is/gives/etc.* A DISCUSSION OF
    - (e) *This short/etc. paper is/gives/etc.* A DISCUSSION OF—
    - (f) *The major portion of this paper/report/etc. is devoted to* A DISCUSSION OF—
    - (g) *Included in this paper is* A DISCUSSION OF—
2. *Passive*.
    - (a) A DISCUSSION OF— is given/presented/etc.
    - (b) *In this paper/report/etc.* + (a)
    - (c) *In this paper/etc.* on — + (a)
    - (d) (a) + *by the author/the writer/etc.*
    - (e) A DISCUSSION OF— *is briefly presented/is given in the n pages of this paper/etc.*

Surely, there are less possibilities of reconstruction in the attested sentences quoted below in (46) (a), (b), and (c), as is suggested in (d) to (g). But the very possibility of having conjunctions of semantically different nominals such as those underlined in (a), (b) and (c) suggests that a linguistic theory should generate such nominals directly in the base *as they appear in the surface constructions*, rather than derive them from more complete or explicit deep-structure representations.

(46)

(a) Introduction to mechanical documentation methods
Brief *description and applications of* peek-a-boo and edge- punched cards... (J 1080).

(b) Experiences with edge notched cards in a neurological clinic (title)
Description and use of a simplified two-edged notched card for recording case histories... (J 327).

(c) The authors present *a design and discussion of* bibliographic punched card... (J 389).

(d) The author presents/gives *a description and the (a ?) use of* ...

(e) *A description and the (a ?) use of* ... is given/presented.

(f) * This is *a description and use of* ...

(g) * The author/the paper includes/offers *a discussion and use of* ...

Note, moreover, that the following sentences are dubious if not completely unacceptable, which to me is a further argument for the approach I propose :

(47)

(a) ? Discusses x and the paper describes y.
(b) ? Discusses x and the author describes y.
(c) ? A discussion of x and the paper describes y.
(d) ? A discussion of x and the author describes y.
(e) ? x is discussed and the paper describes y.
(f) ? x is discussed and the author describes y.
(g) ? x is discussed and a description of y.

Lastly note that the need for 'incomplete' deep-structures is also suggested by the use of pronouns in the following, articulate, sentences :

(48)

(a) The author describes his as yet incomplete work on... He explains and justifies his method... and expresses his confiddnce that— (J 126).

(b) The paper describes incomplete work on ... It explains and justifies the method... and expresses Ø confidence that—

(c) * The paper describes (his) as yet incomplete work on ...
He explains and justifies his method... and expresses his confidence that—

In connection with Levin's third point, it also seems impossible to posit definite pronouns for Agent ('AUTHOR') and Locative ('TEXT') in the semi-articulate sentences under discussion. This, at least, is the case with verbal constructions, as is shown in (49). On the other hand, as far as pronominalization is concerned, nominal constructions like 'A discussion of—' act as synonyms of nouns like 'text', as is shown in (50).

(49)

(a) * Discusses ... HE describes...
(b) * Discusses ... IT describes...
(c) * ... is discussed. HE/IT describes.

(50)

(a) An evaluation of —. *It* recommands that— (J 55).
(a') An annual review of—. In addition, *it* includes lists of— (J 230).
(b) Describes— *This* includes both review of— and — (J 267).
(c) *A* general description of—. *The description* is rather short— (J 928).
(d) Summary of—, including description of— (J 31).
(d') An appendix follows, listing— (J 135).

Let us now turn to inarticulate sentences. Most titles of the Janaske corpus are of the inarticulate type. But occasionally, as in the following examples, the first (as well as other sentences of the abstracts are inarticulate and consist of just a noun-phrase (cp. Jespersen's "Thanks"):

(51)

(a) Searching medicinal chemical literature (title).
Three representative problems of a manufacturer of fine chemicals in searching for information in the medical and chemical literautre : ... (J 3).
(b) Mechanized indexing of information on chemical compounds in plants (title).
A system devised for ... (J 168).
(c) Card-form publications in medicine and related fields (title).
Advantages and disadvantages of card-form publications. (J 324).
(d) Symbolic shorthand system for medicine and physiology (title).
A system for classifying and indexing medical literature using ... (J 884).

Here again, it seems impossible to decide which articulate sentence could be said to correspond to the 'best' deep structure representation of the inarticulate sentences in question (Levin's first point and Jespersen's observation about "*Special edition !*", etc.), even though some reconstructions are definitely ruled out. This is shown in (52) :

(52)

- The author discusses
- The author presents a thorough discussion of
- The author outlines
- The author presents
- The author analyzes
- The author evaluates (a method/system)(?)
- The author defines
- The author introduces(?)
- The author stresses (advantages)
- The author states (problems, advantages)
- The author explores(?)
- etc.
- * The author advocates
- * The author predicts

- three representative problems of ...
- a system devised for...
- advantages and disadvantages of ...
- a system for ...

The following examples (53), however, suggest that what has just been said needs to be qualified. In (a), we have 'Study of' introducing 'a method for—' in the title, but only the noun-phrase introduced by 'Study of' is repeated in the first sentence of the abstract. The converse situation, which is not exemplified, is more frequent : see (44). (b) and (c) are even more intriguing. In (b) '—are ALSO discussed' appears in the fifth sentence of the abstract WITHOUT any previous occurrence of 'discuss' or the like, and in (c) 'these proposals' also occurs without previous occurrence of 'propose' or the like in a preceding sentence. Example (d) suggests a further problem, namely how inarticulate sentences like 'A method for ...' in (a) relate to ARTICULATE sentences with NO verb such as 'discuss' or a cognate nominal.

(53)

(a) (Analytical and experimental) study of a method for literature search in abstracting journals (= title).
A method for literature search using abstracting journals developed by ... (= first sentence : J 156).

(b) The book-form index requires no searching machine, and the coordinate searching can be done by a clerical person. Each document is entered in one place, and the documents can be almost in any order. A document entry consists of a single (or multi-) character abbreviation for each term the document possesses, and a document identification. The document identification may be anything from a serial number to a brief abstract; micro-reduced document identifications are also discussed. (J 721).

(c) The author has developed a set of elements which should appear in all agreements or contracts between organizations supporting research and organizations receiving the support. These proposals are based on 25 case studies (J 359).

(d) A system has been designed for preparing bibliographic reports ... (first sentence of J 362).

Considering the above examples I would propose the following :

(i) Contrary to what I have argued about 'AUTHOR' and 'TEXT', I feel that it is both possible and necessary to posit a predicate such as 'Study of' or 'Discussion of' for the inarticulate sentences (such as that in 53a), and for most titles, and articulate sentences that do not contain such a predicate in their surface form.

(ii) Such sentences could then be treated as instances of recoverable deletion, provided the appropriate predicate can be "actually mentioned" in their structure index. While this no doubt presents problems in examples like (53) (c) ('These proposals...'), I suggest that obvious candidates as appropriate predicates are the most general predicates such as DISCUSS, CONCERN, and STATE (that). By 'most general', I mean those that can always serve to replace others on the basis of unilateral implication rules : thus 'analyze x', or 'explain x', or 'list x' all imply DISCUSS x, but not vice versa.

(iii) If (i) and (ii) are correct, both inarticulate sentences such as (53) (a) ('A method for ...') and articulate sentences such as (53) (d) ('A system has been designed for...') can be represented in deep structure as having the form Predicate + Topic : respectively 'Discusses (or A discussion of) + Topic = a method for...' and 'States that + Topic = a system has been designed for ... On this basis, such sentences can be related by implication rules to articulate sentences of the type 'The author discusses x'(cp. implicit performatives).

(iv) While I realize that the notion of topic in linguistic theory is far from clear, I suggest that my proposal to give the same semantic analysis (Predicate + Topic) to syntactically different verbs like 'discuss' and 'state that' is not unreasonable considering the possibility of paraphrases illustrated below in (54); (d) is based on a suggestion made by Lakoff (George Lakoff 1969c, 30-31).

(54)

(a) Original sentence (sentence 1 of J 404).
Before any automatic system for storing, searching, and retrieval of information can be effective, it is necessary to develop an efficient and economic method of placing and locating the information in the system.

(b) Modified version 1.
STATES THAT + (a) = Topic

(c) Modified version 2.
DISCUSSES + Topic = the need to develop an efficient and economic method of placing and locating (the) information (in the system) before any automatic system for storing, searching, and retrieval of information can be effective.

(d) Modified version 3.
CONCERNING + Topic = automatic systems for ...
IT IS STATED that + Topic = it is necessary to develop an efficient and economic method of placing and locating the information in THEM.

(v) If (iv) is correct, it suggests that sentences like (54) (a) as a whole can be considered as a Topic. This, I suggest, is not unreasonable and can be regarded as a formulation of the 'implicit performative hypothesis' in terms of a case theory framework. Under such a view, then, there would be no difference between (54) (a) and (b) as far as their Topic is concerned, the topic of (54) (c) would be a noun-phrase with 'noed' as a head-noun, and (54) (d) would have two Topics : 'automatic systems for...', and a that-clause which is equivalent to (54) (a) and (b). Similarly, the only difference as far as Topic is concerned, between "(STATES that) a system has been designed for ..."(J 362) and, say, "(DISCUSSES) a system devised for..." (J 168) would be captured in the grammar, in terms of the difference between a sentence and the corresponding noun-phrase with a relative clause. In the next chapter, I shall argue that the above proposals are relevant to some problems of identity in discourse and of discourse structure.

3.3. CONJUNCTION, RELATIVE CLAUSES AND PRESUPPOSITION.

3.3.1. Some marks and factors of identity.

Ignoring various details and problems, the review of recent studies on conjunction presented in 3.1.4. leaves us with the general assumption that and-conjunction imposes identity constraints on what it conjoins, and with the following, more specific, assumptions :

(i) sentences in a text or discourse are relatable by and or some other conjunction, so that some identities must be statable between them (Katz and Fodor, and Harris);
(ii) identities must be statable between conjoined sentence constituents, such as noun-phrases or verb-phrases (particularly under the hypothesis that the source is a conjunction of sentences);
(iii) it is necessary to distinguish between symmetric and asymmetric 'and' and these two types of 'and' may require different semantic representations.

In this section, I shall briefly discuss and illustrate three factors of identity :
(i) case structure;
(ii) marks of time sequence;
(iii) deixis.
Later in this chapter, I shall examine some of these points (next to a few others) in more detail. To begin with, I shall suggest briefly how case representations can throw light on the problem of identity in conjoined sentences. In (1), (2), and (3), I wish to suggest the following. On the basis of the hypotheses put forward in the preceding chapter, the sentences of the illustrative abstracts quoted in (a) can be represented in terms of the general format Predicate + Topic given in (b). The representations of (b) 'normalize' the texts, on the basis of an application relation between various sentences and DISCUSS (or STATE) + Topic.

in such a way that each sentence has the same representation; and,on the basis of both the Harris-Lakoff hypothesis about identity between conjoined sentences and the Katz-Postal hypothesis about texts being reducible to a conjunction of their constituent sentences, we can represent all the illustrative abstracts as Predicate + Topic AND Predicate + Topic AND ...

(1)

(a) Points out the value of abstracts (particularly informative abstracts), sets forth standards for a good abstract and examines critically a number of abstract services and shows why they do not meet the standards.
Discusses the question of who should prepare abstracts and indexes and examines critically Australian abstracting and indexing service (J 399).

(b) DISCUSS + Topic ("the value..."), DISCUSS + Topic ("standards...") and DISCUSS + Topic ("a number...") and DISCUSS + Topic (the reason "why ...").
DISCUSS + Topic ("the question...") and DISCUSS + Topic ("Australian...").

(2)

(a) Methods used by the Thermophysical Properties Research Center for handling collected bibliographical information on thermophysical properties are described. Details are given regarding the method of coding abstracts for reproduction on IBM cards, particularly the coding of substances and the system of substance classification and notation used. Procedures used to store the punched card information on magnetic tape are described. Systems of retrieval of this stored information are delineated including a description of the organization of the retrieved bibliography and of the machine techniquesinvolved. The system described is claimed to be extensible to some other portions of scientific literature. Announced in this paper are the Center's plans to make available an annual index to the literature of thermophysical properties, expected to start publication in 1959. This book-form index--essentially the output of the Center's retrieval equipment--is described in prospect as a definitive, cross-indexed bibliography of every paper, book, report, or patent containing thermal property information. (J 985).

(b) *DISCUSS + Topic* ("methods used..."). *DISCUSS + Topic* ("the method of coding..."). *DISCUSS + Topic* ("procedures used..."). *DISCUSS + Topic* ("systems of retrieval...") and (?) *DISCUSS + Topic* ("the organization of ..."). *SAY ("is claimed") + Topic* ("the system described is claimed..." : I shall return below to the problem arising with "system described"). *DISCUSS + Topic* ("this book-form index... as ...": I do not go into the problem raised by "describe x *as* y").

(3)

(a) Information retrieval techniques to make the vast store of knowledge conveniently accessible are still far short of what's needed. The difficult problem is not devices and technology, it's the intellectual job of matching what 's known and what's wanted (J 4C7).

(c) *STATE + Topic* (that "information retrieval techniques... ..."). *STATE + Topic* (that "the difficult problem...").

Another way in which case representations can serve to state identities is the following. As will be remembered, Fillmore's first definition of the "*Objective*" case was : "the semantically most neutral case, the case of anything representable by a noun whose role in the action or state identified by the verb is identified by the semantic interpretation of the verb itself" (Fillmore 1968a, 25). Later, he defined the "*Object*" as "the entity that moves or changes or whose position or existence is in consideration" (1969a, 77). Both definitions can serve as a basis for regarding the NP's with '*information*' in (4) (a) as exponents of the Objective case so that part of the sentence given in (b) can be represented by a conjunction of *N + O = information* as in (c) (following Stockwell *et al.* 1968, PS rule 7, 34). Without going into the problem of 'nominalization', it is clear that the conjunction of gerunds in (4) is equivalent to a conjunction of sentences.

(4)

(a) Most information retrieval systems depend upon extracting information from documents, processing such information in some manner and finally placing this information in a file so that the information can be retrieved by machine (J 321).

(b) Extracting information, processing such information, and placing this information.

(c) *N + 0 = information* AND *N + 0 = information* AND *N + 0 = information*.

I suggest that such an analysis can serve to explain why the Lévy concordance is entitled "Etude de concordance interlexicale *dans le domaine de l'information scientifique et technique*" (*in the field of scientific and technical information*) Under my assumption, it seems natural that the authors should have thought of *scientific and technical information* as the 'topic' (in R. Lakoff's sense) common to all their classification entries. This may also serve to explain why *scientific information* often serves as a synonym of '*documentation*'.

A less obvious way in which case representations can throw light on problems of identity in conjunction has to do with the *Result* or *Goal* case. Fillmore defines *Result* as "the entity that comes into existence as a result of the action". Now, compare the conjunction given in (5) (a) and the near-synonymous expression in (b), and note the oddity of (c) :

(5)

(a) *develop* and *apply* automatic techniques (J 819).
(b) the system was *developed* for *use*... (J 115).
(c) ? apply (use) and develop a system.

(b) suggests that (a) is an instance of *asymmetric* conjunction (more on this in 3.3.3.). Now, *develop* can be analyzed as requiring a *Result*, whose exponents are *'techniques'* in (a) and *system* in (b), while, the same words in relation to *'apply'* and *'use'* must be regarded as exponents of another case - presumably *Instrumental*. It is therefore reasonable to assume that part of the meaning of asymmetric conjunctions could be represented in terms of a shift in which the *same entity* is a Result or Goal in the first conjoined sentence and another case in the second. The same turns out to be true of an example given by Langendoen (1969, 45) :

(6)

(a) The bartender made the martini,
and then drank it.
(a') MAKE + Goal = martini *and then* DRINK + Object = martini.
(b) x The bartender drank the martini, and then he made it.

One last point may be made here about the relations between case structure and conjunction. It is clear that for somebody to be able to draw some *'conclusion'*, there must be some *'basis'* for the conclusion. Now, the Janaske corpus provides ample evidence for considering that some constituent, which I would represent as an Instrument, can be posited to be present in all sentences with *'conclude'* and a few other verbs : 'Conclude + Instrument = on this basis'. The instrumental analysis of these constituents is justifiable on the basis of Fillmore's definition of the Instrumental as "the case of the inanimate force or object causally involved in the action or state identified by the verb" (1968a, 24) or of the Instrument as "the stimulus or immediate physical cause of an event" (1969a, 77). In (7) (a), I give an example in which no Instrumental constituent is present. Such a constituent, however can be assumed to be implicit, on the basis of the other examples given in (7). The constituents which I assume to be

Instrumentals are underlined, and the relevant predicates are capitalized; the question whether the underlined expression in (e) is a constituent of the sentence with 'reviews' is of course debatable, and current research (to my knowledge) provides no undisputed answer to the question (Fillmore 1969a does not discuss examples like those given below; nor does he posit Instrument in the lexical entry of 'verbs of judging' such as CRITICIZE).

(7)

(a) In addition to presenting a general review of—, and a review of—, this article presents a review of—. The author CONCLUDES that— (J 5).

(b) Testimony before the Moss Committee—. It is CLEAR from the testimony that—. All the testimony POINTS to the CONCLUSION that — (J 784).

(c) The author's belief is that—. Upon this foundation, he CRITICIZES— (J 54).

(d) On the premise that—, the writer DISCUSSES— (J 289).

(e) Based on—, this paper REVIEWS— (J 336).

I suggest, then, that such sentences can be represented as 'Predicate + Instrument', where Instrument is a sentence or refers to the preceding sentences in the text, as does "Upon this foundation". If I am correct, Instrumental NP's like "Upon this foundation" serve to introduce identity into a text, and we can represent texts like (7) (c) as follows : S1 and S2 (= CRITICIZES + I = NP = "On the basis of S1").

Marks of time sequence are the second factor of identity I wish to examine here. I shall not further discuss the problem in this thesis, but I think that it is worth mentioning, even though no linguistic theory known to me has anything to say about the expressions exemplified below. First, there are various expressions which serve to refer to aspects of the linearity of discourse (generally the abstracted document). Superficially they can belong to various parts of speech categories but they have comparable meanings. Consider the following attested expressions and their acceptable and unacceptable paraphrases in (8) :

(8)

(a) A brief review of—. —is tabulated. The article *ends* with a plea for—. (J 487).
(a') ... *Finally*, there is a plea for—
(a'')... There is a *final* plea for—
(a''')...* There is a *last* plea for—
(b) On the premise that—, the writer discusses—
In *the last*, he cautions against— (J 284).
(b') ... The article *ends* with the warning that— (?)
(b'') ... There is a *final* warning that— (?)
(b''')...* There is a *last* warning that— (?)
(c) This report deals with—.— are given;...
A *final* chapter is devoted to— (J 872).
(c') ... *Finally*, there is a chapter— (this can, but need not be equivalent to c)
(c'') ...A/The *last* chapter is devoted to—
(c''')... The report *ends* with a chapter...
(c'''')... *In the last*, there is a chapter...
(d) *In addition to describing*—, the author describes—.
He also includes—.
Finally, there is presented an explanation of—
(J 421).
(d') * There is a *final* explanation of— (?)
(d'') * There is a *last* explanation of—
(d''') *In the last*, there is an explanation of—
(d'''') The report/article/etc. *ends* with an explanation of...
(e) ...some questions are raised, among them : (...)
And finally, will ... be ... ? (J 374).
(e') A/One *final*/*last* question is whether ... will... be...
(e'') The author/The paper (?) *ends* by asking the question whether...
(e''') *In the last*, the question is asked whether...

On the basis of (e), we can assume that an '*and*' is implicit in all the other sentences given in (8). An argument for regarding this '*and*' as asymmetric is that the above sentences would be very odd indeed at the beginning of a text.

The other expressions which refer to the linearity of discourse and which seem to be naturally linked by (or equivalent with) asymmetric *and* are enumerations and expressions with *before*, *after* or equivalent verbs as illustrated below in (9). Note that the last point of the enumerations could be introduced by *and finally*, or various synonyms. Also note the equivalence between '*Also*' standing at the beginning of a sentence in (e), and the sentences with '*follow*' and '*is followed*'. The only expressions which are not clearly asymmetric are '*in addition*'/'*in addition to*' /'*Additional*'... in (g), (k), and (l)

(9)

(a) —is divided into the following parts : (1)—; (2)—; (3)—; and (4)—.
(b) *First*, this is a discussion of—. *Second*, the consequences of— are drawn. *Third*, this describes— (J 853).
(c) A description of— *is followed* by two appendices... (J 33).
(d) This annotated bibliography of— presents—. An appendix *follows*, listing—, with a brief description of—. — indexes *follow* appendix.(J 135).
(e) A review of—. The author concludes that—. *Also*,— . As a final comment the author *adds* that—
(f) *After*...
(g) The authors describe—. *Preceding* discussion of—, a brief description is given of—. A short discussion of— *terminates* the paper. (J 638).
(h) ... A bibliography of— is *appended*. (J 265).
(i) —- is traced—. A brief evaluation is *then* given of— (J 880).
(j) *In addition*, it appears that ...(J22)
(k) *In addition* to presenting a general review of—, and a review of—, this article presents a review of—. (J 5).
(l) *Additional* information concerns— (J 7).

I have no idea how linguistic theory could reconcile the superficial diversity of these expressions with their semantic similarities. The problem is even worse if one considers that the function of many if not most of the expressions given above is by no means restricted to that of marking discourse linearity. This is why the term, '*time sequence*' has been used above in connection with such expressions. Consider the attested occurrence of *and finally* in (10) (a), together with some possible paraphrases.

(10)

(a) Most mechanized information retrieval systems depend upon extracting information from documents, processing such information in some manner *and finally* placing this information in a file *so that* the information can be retrieved by machine. (J 321).
(b) ... depend upon the following sequence of operations ... *After* being processed, the information is placed in a file...
(c) The processing of the information *is followed by* its placement in a file...
(d) The information is extracted ... (and) *then* ...
(e) The *last* operation is the placement... so that...

The paraphrases of '*and finally*' in (10) suggest that this '*and*' is of the asymmetric type, and that Robin Lakoff's hypothesis is correct when she advances that what one means by asymmetric conjunction, and common topic in connection with it, is 'possibility of reduction' to an asymmetric predicate (such as '*follow*' : R. Lakoff 1970, 27). On the other hand, Robin Lakoff's conjecture captures only part of the problems of asymmetric '*and*', as I now wish to show by examining one last mark of identity, namely *deixis*. I shall do this by again returning to the sentence quoted in (4) (a) and (10) (a). The points I wish to make in connection with deixis are illustrated in (11). In (11) (a) the sentence given in (10) (a) is repeated with the deictic expressions underlined. It seems to me that (11) (b) which preserves these deictic expressions but which has the form of a discourse is an acceptable paraphrase of (a). (c) shows that the discourse of (b) can be converted into a single sentence with relative clauses. (d) shows that (b) can be paraphrased by a discourse in which the deictic expressions are replaced by NP's with relative clauses or relatable constructions, The problem is of course why and when such conversions are possible, and how to represent the process. I shall return to this question below.

(11)

(a) Most information retrieval systems depend upon extracting information from documents, processing *such information* in some manner and finally placing *this information* in a file so that *the information* can be retrieved by machine (J 321).

(b) Most information retrieval systems depend upon three main operations. (The) information is extracted from (the) documents. Then *this/the information/it* is processed in some manner. (And) finally *this/the information/it* is placed in a file. As a result/In this fashion, *the information* can be retrieved by machine.

(c) Most information retrieval systems depend upon extracting from the documents some *information which* is then processed in some manner and *which* is finally placed in a file and *which* can therefore/then be retrieved by machine.

(d) Most information retrieval systems depend upon three operations. (The) information is *extracted* from documents. Then *the information (which has been) extracted (from documents)/the extracted information* is processed in some manner. Finally *the information (which has been extracted... AND) which has been processed/the processed information* is placed in a file. *The information (which has been extracted..., processed... AND) placed in a file/the stored information* is then retrieved by machine.

The following examples given in (12) suggest further complexities in the problem of deixis : (a) and (b) suggest that some reference to *time* sequence may be necessary ("*previously*"), in addition to some reference to tense ("which *has been previously classified*") and to other abstract notions such as '*result*' ("*resulting*"); (c) illustrates the problem, which is a well-attested one in the corpus under investigation, of deictic NP's with no surface antecedent; (d) illustrates the converse situation in which an NP is relatable to a following sentence :

(12)

(a) Encoding of information previously classified. (J 65/cp. J 511).
(a') Cp. : encoding of the(this) information (11a).
(b) ... certain documentation services... involve a regular scrutiny of over one thousand current periodicals with consequent indexing and distribution of the resulting information. (J 466).
(b') Cp. : and indexing and distribution of the(this) information.
(c) Describes a new experimental attempt to develop automatic classifications of chemical concepts and interrelations in the disclosures of the patent literature. In this system, the classification system is made... (J 19).
(d) The system described employs three established techniques : microfilming, punched-cards, and xerography. Documents to be held on file are microfilmed. (J 35).

3.3.2. Discourse, relative clauses and lexical items.

As appeared most clearly in the quotation made from Kuroda in 3.1.4., the question of discourse has long been a neglected area in TG linguistics, and, with the notable exception of Harris, this is also true of other trends of linguistics. Things have changed, however, at least if Robin Lakoff's approach to sentence conjunction may be regarded as typical of an evolution in TG studies. There is further evidence for such an evolution in the fact that in recent years several TG linguists independently arrived at the conclusion that the theory should account for the paraphrase relations between discourses and sentences containing a noun modified by a relative clause (restrictive or not). These relations have been most systematically examined by Annear Thompson in an unpublished dissertation and in two papers (1970 a and b), and, on the basis of her work, Langendoen has proposed rules which *optionally* derive a sentence containing a noun modified by a relative clause from "a discourse consisting of two sentences" (Langendoen 1970, 141-150). Thus, the application of Langendoen's rules has the effect of replacing optionally a pair of sentences such as 'My cousin married *a* girl. She became pregnant' by '*The* girl whom my cousin married became pregnant'. Note that in Langendoen's account: (a) only *pairs* of coordinate sentences are considered as a discourse source; ~~(b)~~ the problem of identity which must hold between them is reduced to the (equally unsolved) problem of 'pronominalization' ('*a* girl. *She*...'); (c) the nature of the relation between the two coordinate sentences is not specified (it is just represented as a period); (d) the (optional) application of the rules for relativization has the effect of *deleting* the discourse source. Points (a) and (c) are also true of Annear's account; (d) is irrelevant, since Annear does not propose any transformations. In particular, Annear leaves open the question of determiners (b). She argues that this has to do with presumably non-syntactic questions concerning "certain presuppositions which the speaker makes about the extent of his listener's knowledge", and she proposes discourse sources for relative clauses of the type (I met *girl*) (*girl* speaks Basque). For Annear, then, the identity (b) which must hold between the pair of sentences serving as the source of a sentence with relative clause seems to be a matter of lexical identity (Annear 1970b, 43).

In spite of their lack of elaboration, the Annear-Langendoen proposals represent a revolution in TG linguistics, since there now exist basically two types of hypotheses about relative clause formation, and there is (as far as I can see) no sign that a reconciliation between them will eventually emerge. Next to the Annear-Langendoen hypothesis, which regards discourse as basic and relative clauses as derived by optional transformations, there are the various hypotheses initiated by Chomsky according to which relative clause formation is *obligatory*, given a deep structure configuration consisting of a noun-phrase with one or more embedded sentences or clauses. As Annear points out (1970b, 42), there is "virtually no agreement" among those who propose this type of analysis as to its detailed formulation (see in particular the review of these hypotheses in Annear *op.cit*. and in Stockwell *et. al.* 1968, Ch. VIII).

In this section, I shall argue that it may not be necessary to reconcile the Annear-Langendoen proposals with the others, because there are reasons for believing that BOTH discourse and relative clauses are basic. I shall do this around the five points (a-e) which I have just mentioned concerning the lack of elaboration of the Annear-Langendoen hypothesis.

I shall go out from texts, that is, abstracts rather than from discourses consisting of no more than two sentences (a). I shall examine the nature of the identity which can be posited to hold between sentences of an abstract. As I wish to show, this identity does not always manifest itself by superficial marks such as deixis ('a girl... This girl') and/or matching lexical items (cp. Harris's "word repetition" : 'girl...girl') (b). I shall also discuss the problem of what can be said to underlie the period of discourse (e.g. 'and', or some other conjunction : c), and I shall present arguments against the deletion of the discourse source - one of the effects of the rules of relativization in Langendoen's formulation (d). I shall present successively evidence FOR and AGAINST the Annear-Langendoen hypothesis.

A most typical feature of the abstracts under investigation is the occurrence in the second or following sentences of deictic noun-phrases (for instance, the N or this N, next to various other possible constructions) where N already occurred in a preceding sentence. When this is the case, it is often possible to convert the abstract into a single sentence with relative clauses, changing the deictic noun-phrase into a relative pronoun. The deictic noun-phrase, then, appears as one of the possible superficial marks in discourse of the identity required for (optional) relative clause formation. As the following examples suggest (13-15), the conversion into a single sentence with relative clauses requires only a few grammatical and occasionally lexical changes (I shall not discuss these here, as I wish to discuss similar problems later in this section). The converse change from a single sentence to a discourse is exemplified in (16). Also note that (13) suggests the need for relative clause formation to be optional : while a single sentence containing, say, ten thousand relative clauses is conceivable, people usually prefer to express themselves by means of the corresponding discourse - a fact which still awaits explanation, within a theory of performance, in psycholinguistics, or otherwise.

(13)

(a) A system has been designed for preparing bibliographic reports using an automatic typewriter, the "Flexowriter", which prepares a punched paper tape simultaneously with the original typing of the reference cards during the progress of the literature search. These tapes, made on a prefolded 8 1/2'' fold tape, may be cut apart, filed, and rearranged in any desired order for the final report... The use of this system has resulted in a saving of 60 % over the time required for manual typing of a bibliographic report. (J 362).

(b) A system (,the use of) which has resulted in a saving of 60 % (...) has been designed for preparing bibliographic reports using an automatic typewriter, the "Flexowriter", which, simultaneously with (...), prepares a punched paper tape, which is made on a prefolded 8 1/2'' fold tape and may be ...

(14)

(a) The ever increasing need for a more efficient organization of medical information in the Soviet Union indicates that the present decentralized and inefficient system of medical documentation should be replaced with a centralized system. The centralization of medical documentation would permit a better utilization of means and personnel already available to various organizations engaged in medical documentation and better dissemination of information through improvement in methods of presentation and enlargement of the scope of medical documentation. (J 42).

(b) ... with a centralized system which would permit...

(15)

(a) The author attempts to demonstrate the existence of a theory more basic than that now published in the literature of the field, and to show how a more fundamental theory might lead to conclusions hitherto not realized. This basic theory is based on the author's definitions of "nature" and "information" which were written to meet the needs of the professional bibliographic organizer. (J 673).

(b) ... how a more fundamental theory which is based on... might lead to ...

(16)

(a) Proposes the creation of national documentation centers which would cooperate with one another in the dissemination and indexing of scientific literature (J 200).
(b) Proposes the creation of national documentation centers. The/these/such centers/They would...

When the sentences of an abstract have a verb of the type discussed in 3.2. as main verb, as in (17) (a), the sentences can be conjoined by 'and' as in (b) and this conjunction can in turn be converted into a single sentence with a relative clause, as in (c) :

(17)

(a) Describes the Uniterm system of indexing being used by the Civil Engineering Department of Case Institute of Technology. The advantages and the limitations to this indexing system are given. (J 674).
(b) Describes the Uniterm system... and gives the advantages and limitations to (?) this indexing system.
(c) Describes the Uniterm system..., the advantages... of which are given.

My discussion in 3.2.3. offers a basis for predicting some changes required by such conversions : e.g. "are given"/ "gives".

Langendoen himself provides an argument (which is based on Ross 1967) for his treatment of discourse as basic. One of the situations defined by Ross in which relativization is ruled out is that in which the relative pronoun would have to originate in a relative clause which is itself inside a relative clause. This is exemplified below in (18); compare the unacceptable paraphrase in (b) with the acceptable one in (c) :

(18)

(a) A general description of the Japan Information Center of Science and Technology which was established for the purpose of contributing to the development of science and technology by collecting, processing, storing, and retrieving scientific information. At the time of this report, the Center was planning to change over to a mechanized storage and retrieval system similar to that used by the U.S. Patent Office. Services available from the Center and the charges for each are listed. (J 1).

(b) A general description of the J IC Sc T which was established for the purpose of contributing to the development of science and technology by ..., (and) which at the time of this report was planning to change over to..., and x which the services THAT ARE AVAILABLE FROM are listed.

(c) A general description of the J IC Sc T which was established..., which at the time... and the services of which are listed.

A further argument for the Annear-Langendoen hypothesis is the following Some abstracts cannot be converted into a single sentence with relative clauses WITHOUT A CHANGE IN MEANING. The reason seems to be that the period of written text cannot be paraphrased by 'and' without changing the meaning. The meaning - preserving paraphrases are with some other coordinating conjunction, or some equivalent subordinating construction. Thus, in (19), I would say that paraphrases (b) and (b') do not preserve the meaning of (a) as do (c) and (d).

(19)

(a) A Uniterm system is used by Humble Oil... It has proven to be most satisfactory for their purposes. The system cut indexing time, increased retrieval speed,...

(b) The Uniterm system used by H.O. has proven to be most satisfactory for their purposes and it cut indexing time,...

(b') The Uniterm system used by H.O. which cut indexing time, increased retrieval speed, (...) has proven to be most satisfactory for their purposes.

(c) The Uniterm system used by H.O. has proven to be most satisfactory for their purposes in that it ...
(d) The Uniterm system used by H.O. has proven to be most satisfactory for their purposes. The reason is that...

Occasionally, in some abstracts, there is no surface mark of identity - such as deictic noun-phrases - of the type required for relative clause formation. Another, similar, situation is that in which deictic noun-phrases occur without any previous occurrence of a lexically identical antecedent. This could at first be regarded as an argument for the Annear-Langendoen conception of discourse as basic. On the other hand, it seems that it is always possible to reconstruct the texts in such a way that relative clause formation is possible. Unfortunately, no theory is currently able to explain such reconstructions; I shall return to some of them later in this thesis. The texts, together with the corresponding reconstructions and relative clause constructions, are given below in (20) to (25) :

(20)

(a) Proposal for the creation of a permanent international organization which would have charge of the accumulation of medical data in the world literature, and of an analysis and synthesis of these data. By means of cards and leaflets, physicians could have information on new developments in all subjects and fields of medical science (J 432).
(b) Proposal for the creation of a permanent international organization which would have charge of the accumulation of medical data in the world literature, of an analysis and synthesis of these data, and of the distribution of cards and leaflets. By means of these, ...
(c) (as in b except:) by means of which...

(21)

(a) ... this is becoming more and more difficult. The keys to this problem are... (J 889).
(b) ... this is becoming more and more of a problem/ ...this raises more and more problems. The keys to these problems/this problem...
(c) ..., the keys to which ...

(22)

(a) A report of a three weeks' trip to 22 technical information centers on the continent of Europe. The three aims of the trip were : 1) to examine methods of operating information services; 2) to study the attitude of industrial management and research toward technical information, and 3) to contact some of the leading people in the technical information field in Western Europe. Each center visited is fully described, and its available information and library services is given. (J 887)(sic).

(b) ... trip for the purpose of visiting... centers... Each center visited...

(c) A report of a three weeks' trip (the three aims of which were : ...) for the purpose of visiting 22 technical information centers on the continent of Europe, which are fully described and whose available information and library services are given.

(23)

(a) This paper analyzes—. It also analyzes—. On these bases, the paper presents— (J 963).

(b) This paper analyzes— and —, upon which bases it presents—

(c) This paper analyzes— and —, on the basis of which analyses it presents—

(24)

(a) The author's belief is "that a clear understanding of the distinction between information retrieval systems, the function of which is to make detailed, factual information available, quickly, cheaply, and reliably, and literature search systems, the function of which is to provide a bibliography of documents for the use of the investigator of a specific problem, and of the related distinction between the information-condensing function of tne abstract and the clue-providing function an index, is necessary for progress in information searching". Upon this foundation, he criticises six theories upon which experimental information retrieval systems have been based. These six theories are found in the writing of such well known groups and individuals as Perry and Associates and Dr. Mortimer Taube. (J 54).

(b) — upon which foundation he...

(c) The author's belief, which serves him as a foundation for criticizing six theories upon which... and which are found in ..., is that ...

(25)

(a) Describes a new experimental attempt to develop automatic classifications of chemical concepts and interrelations in the disclosures of the patent literature. In this system, the classification system is made from the disclosures in the patent literature, thereby making it possible to... (J 19).
(b) Describes ... in which the classification system is made from the disclosures...

On the basis of the arguments given so far, there are good reasons for believing that discourse is basic and that relative clauses are optionally derived from discourses. I shall now turn to counter-arguments, which go to show that constructions with or relatable to relative clauses are also basic.

Let us first consider definitions where the definiendum is a construction usually regarded as relatable to relative clauses, such as "inverted file" in the following example (26). In such definitions, it seems that both the discourse paraphrase (b) and the corresponding relative clause construction are unacceptable (Postal has given most striking examples which show that noun-phrases with relative clauses and nouns synonymous with them have different syntactic behaviours. Compare, for instance, 'People who smoke really shouldn't do so' and '* Smokers really shouldn't do so', 'People who study Iroquoian sometimes deny they do so' and '* Iroquoianists sometimes deny they do so' : Postal 1969, 217) :

(26)

(a) An inverted file is an organizing system for the stored information in a machine memory so the information is divided into as many sections as there are different codes representing all of the subunits of information in all of the documents in the memory of the machine.
(b) * Some files are inverted. These files constitute a system. This system organizes information. The information is stored in a memory. The memory is in a machine. The information is organized so that...
(c) * A file which is inverted is a system which serves to organize...

Second, relative clauses with 'so'and 'thus' meaning 'in this fashion' cannot be derived from a discourse source already containing 'so' or 'thus'. These adverbials would have to be introduced transformationally, and, as far as I can see, there is no justification for doing this. What is true of NP's with 'Ved' and 'so' or 'thus' is even more obviously true of NP's with words like "(the) above-mentioned", and synonyms, as is shown in (27): for instance, you cannot derive the sentence 'I am interested in the above-mentioned NP" from "* I mention NP above and I am interested in NP". A similar example with 'so' is given in (28). In (27), note the occurrence of "each publication (which is) thus uncovered" and of "the above-mentioned properties" with NO previous occurrence of 'uncover'or 'mention'; I shall discuss what I believe to be a similar situation below in connection with example (30).

(27)

> A method for literature search using abstracting journals developed by Lykoudis, Liley and Touloukian. Consists of searching an abstracting journal for a certain period of time and then obtaining new information by going through the bibliography section of the papers located by the direct search of the abstracting journal. This procedure can be repeated in cycles. According to the model of this method a direct search of Chemical Abstracts is made to locate publications on seven thermophysical properties (thermal conductivity, specific heat, viscosity, diffusion coefficient emissivity, thermal diffusivity, and Prandtl number) for all matter for the period between January 1954 and December 1967. The references cited by each publication thus uncovered are searched to obtain further new information on the above-mentioned properties. (J 156).

(28)

> The essential purpose of literature searching is to locate those documents within a collection which have a bearing on a question asked of it. In considering the design of a system for selecting and correlating information in response to questions, it is important to recall that, in the particular application of selecting systems, the retrieval of needed information from a file is usually in two steps : (1) the selection system is operated to identify those documents of probable pertinent interest; and (2) the documents so selected are subjected to personal review to locate the desired information. (J 773).

Third, contrary to the rules formulated by Langendoen on the basis of the Annear hypothesis, I have found many examples in the abstracts of the Janaske corpus in which the occurrence of a relative clause does not go together with a deletion of its discourse source. Let me give just one of these examples. Compare the underlined portions of the following quotation (29) :

(29)

> As an improvement on the card reference information file commonly used by engineers, a modified system using marginal punched cards is described. This punched card system enables information to be retrieved from a file on the basis of several classifications. Specifically, the system described uses... (J 440).

This suggests that either the deletion of the source conjunct of relative clauses should be made optional in the Annear-Langendoen rule, OR that the deletion of the relative clause should be made optional, with both this relative clause and its discourse sources being generated in the base.

Moreover, it is often the case that the superficial 'discourse source' and the relative clause construction do not match lexically. The situation with which I am concerned here (30) is, I believe, different from that of (22) ("trip"... "visited"). Here, a reconstruction by adding some material is neither necessary nor possible. If the sentences with 'deals with' and 'is concerned with' in (30) are rightly regarded as the source of '(systems described)' - as I think they should be - the abstract quoted below suggests that lexical insertion should be made sensitive to the kind of implication rules I have proposed in 3.2. : 'TEXT' deals with TOPIC as well as 'TEXT is concerned with TOPIC'imply TOPIC is described, and by virtue of this implication "Systems described are..." (= ... are the systems which are described) can be used just as if a sentence such as, say, 'punched-card systems are described' actually occurred in what precedes :

(30)

> This article is divided into five parts. "The first deals with edge-notched punched cards and related equipment; the second with tabulating type punched cards; the third is concerned with supplements to punched cards; the fourth with other types of equipment related to information processing; and the fifth with ancillary equipment for punched-card systems." Systems described are Keysort, E-Z Sort, Unisort, Findex, Flexisort, Needlesort, Zatocoding, Microtape, Uniterm, and Filmorex. (J 822).

A similar absence of lexical match is exemplified below in (31). Compare "which (= and it) is permanently filed in a central repository" and "on deposit"(= 'which is filed') in the following abstract :

(31)

> A letter to the editor proposing the following system of communication research results : The contributor prepares a full account of his research, sparing no detail, which is permanently filed in a central repository...[and] a two-page abridgment, which is published in journal form and numbered for identification, and a conventional abstract, which is reproduced on cards (border-punched preferably). A subscriber may receive the journal and the cards or, if he prefers, just the cards and may order by postcard photocopies or facsimile reproductions of the full papers on deposit. (J783).

Similarly, note the underlined constructions in the following abstract. Note that "are described", which can be regarded as the 'source' of "(system) described", is not deletable. This is also true of "Store... information" which precedes "this stored information" and of "retrieval" preceding "the retrieved bibliography". Note especially three very puzzling NP's : "the punched card information", which is relatable to the preceding sentence about 'abstracts being coded for reproduction on IBM cards'; "an annual index to..."and "This book-form index-essentially the output of the Center's retrieval equipment" are equivalent to "The retrieved bibliography" and the NP with "cross-indexed bibliography" to something like 'cross-indexed information'.

(32)

> Methods used by the Thermophysical Properties Research Center for handling collected bibliographical information on thermophysical properties are described. Details are given regarding the method of coding abstracts for reproduction on IBM cards, particularly the coding of substances and the system of substance classification and notation used. Procedures used to store the punched card information on magnetic tape are described. Systems of retrieval of this stored information are delineated including a description of the organization of the retrieved bibliography and of the machine techniques involved. The system described is claimed to be extensible to some other portions of scientific literature. Announced in this paper are the Center's plans to make available an annual index to the literature of thermophysical properties, expected to start publication in 1959. This book-form-index--essentially the output of the Center's retrieval equipment-- is described in prospect as a definitive, cross-indexed bibliography of every paper, book, report, or patent containing thermal property information. (J 985).

Also note that the above abstract displays the kind of relations between deixis and relative clauses discussed in the preceding section.

One last argument for regarding relative clauses as basic is related to what has been said about definitions, and about the occasional absence of lexical match between a relative clause and its discourse source as posited in the Annear-Langendoen hypothesis. The argument has to do with the relations between surface nouns and NP's with relative clauses (on this : Bach 1968). That a theory must somehow state the relatedness is clear from examples like the following:

(33)

(a) a machine that passively classifies its inputs (J 483).
(a') machines ... are only able to retrieve what has been put into them (J 364).
(a'') the machine is neither able to think about the information put into it nor able to forget obsolete information (J 364).
(b) the stored information or file of information (J 68).

Langendoen, who follows Bach 1968, attempts to go a step further by extending Bach's proposals in terms of his own proposals about relative clauses. Bach, let us say, had claimed that (34) (b) was the deep structure of (34) (a). Going a step further, Langendoen claims that this deep structure is actually (c) :

(34)

(a) An expert will speak.
(b) Someone who is an expert will speak
(c) Someone is an expert. He will speak.

(Langendoen 1970, 148)

My first objection to such a proposal is that it sounds absolutely ludicrous to posit a discourse source for various noun-phrases with adjectives and participles (which the transformational tradition equally oddly relates to relative clauses). Consider, for instance, expressions like "human being", "clerical person", "living object", and names of institutions like "American Council of Learned Societies".

My second objection is that I see no way of generating definienda or expressions similar to definitions like "the stored information OR file of information" (J 68) on the basis of Langendoen's proposal.

My third objection is a more general one which, however, is relatable to the first two. Following George Lakoff (particularly 1969c, 3 and 29), I would say that language offers the possibility of expressing the same information in two mutually incompatible but equally basic ways, namely by asserting this information (that is, presenting it as something new) or, on the contrary, by presupposing that it is known by the listener or reader; and that relative clauses and lexical items are precisely the most important means by which presupposed information is conveyed. For instance, George Lakoff would say that the sentence, 'John's murderer reads dirty books' "presupposes" that John has been murdered and that some books are dirty, and that all the sentence asserts as something new is the 'reading' relation between these two presuppositions (loc. cit.).

If the arguments presented in this section are correct, BOTH discourses and relative clauses are basic (i.e. should be generated in the base), and the question is then how relative clauses are to be generated. In answer to this question, I can only put forward the general suggestion that the generation of relative clauses should be based on Langendoen's concept of projection (1967). I shall not attempt to go beyond this general suggestion, however, because of complications arising with asymmetric conjunction. These are dealt with in the next section, and I shall return to the problem in chapter 3.4.

3.3.3. *Asymmetric conjunction and documentation*.

This section is devoted to a preliminary exploration of what underlies asymmetric '*and*' in various expressions having to do with the concept of documentation. I feel that this concentration on examples from this conceptual field is necessary to serve the requirements of *distinctiveness* of semantic analysis as defined in Part I of this thesis. On the other hand, I wish suggest that R. Lakoff's asymmetric conjunction is an important mechanism in language and that it is by no means an idiosyncracy of the conceptual field of documentation.

I believe that some of the following sentences are instances of asymmetric *and*, the written version of which may be a *comma* or a *comma + and* . I shall not further discuss these examples but wish to present them here in order to suggest the relevance of the ensuing discussion to conceptual fields other than documentation. With some qualifications to be discussed below, one fairly clear criterion for regarding a conjunction as asymmetric is that the order of the conjuncts cannot be reversed without producing some oddity, or some change in meaning. Compare the symmetric example in (35) (a) with the asymmetric examples in (b), (c), and (d) and the same examples with the order reversed:

(35)

(a) Summary of symposium on aeronautical documentation in the several NATO countries, including description of efforts in Canada, France, Holland, Federal Republic of Germany, U.S.A., *and* Italy. (J 31)

(a') ... efforts in Italy, U S.A., Federal Republic of Germany, Holland, France, *and* Canada.

(b) Selection, training, *and* relocation of personnel (J 999).

(b') ? Relocation, training *and* selection of personnel.

(c) Results of tests... are ... presented *and* analyzed (J 1111).

(c') ? Results are analyzed and presented .
(d) Experience in setting up/installing and using the... system (J 122).
(d') ? using and setting up the system.

Before turning to examples from the field of documentation, let me further examine the effect of reversing the order of conjoined sentences in asymmetric (36) and symmetric conjunction (37).(36) (a) is adapted from one of Jespersen's examples to which I shall again return below; (36) (b) shows that reversing the order of the conjuncts changes the meaning of (a). This, however, is not the case with symmetric conjunction, as is shown in (37) (a) and (b).

(36)

(a) The doctor arrived rapidly AND the patient soon recovered.
(b) The patient soon recovered AND the doctor arrived rapidly.

(37)

(a) John works for IBM AND he plays tennis very well.
(b) John plays tennis very well AND he works for IBM.

Now, reversing the order of the conjuncts is by no means the only test for establishing the asymmetric nature of conjunction.(38) (a) and (b) are borrowed from Jespersen (1965, 137 and 1966, 316). The remaining sentences of (38) are clearly related to the first two in meaning, and this, I suggest must be regarded as evidence for the asymmetric character of the conjunctions ('and' or semi-colon) in (a).

(38)

(a) The Doctor arrived extremely quickly AND examined the patient uncommonly carefully; she recovered very speedily.
(b) The Doctor arrived extremely quickly AND examined the patient uncommonly carefully; THE RESULT WAS THAT she recovered very speedily.
(c) The doctor's extremely quick arrival AND uncommonly careful examination of the patient BROUGHT ABOUT her very speedy recovery.

(d) BECAUSE the doctor arrived quickly AND (BECAUSE he) examined the patient very carefully, she soon recovered.
(e) THANKS TO the doctor's quick arrival and (THANKS TO his) careful examination of the patient, she soon recovered.
(f) The doctor arrived quickly AND examined the patient very carefully IN ORDER THAT she might soon recover.
(g) The doctor arrived quickly AND examined the patient very carefully SO THAT she soon recovered.
(h) The patient WHO had been examined very carefully by the doctor WHO had arrived very quickly recovered very speedily.
(i) IF the doctor arrives very quickly AND examines the patient carefully, she will soon recover.
(j) IF the patient is to recover soon, the doctor must arrive very quickly and examine her very carefully.
(k) The patient will not recover UNLESS the doctor arrives very quickly and examines her very carefully.
(l) The doctor's quick arrival AND careful examination of the patient will ENABLE her/will MAKE IT POSSIBLE for her/IS NECESSARY for her to recover speedily.
(m) BY arriving very quickly AND (BY) examining the patient very carefully, the doctor ENABLED her TO recover speedily.
(n) The patient's speedy recovery DEPENDS ON the doctor's quick arrival AND on his careful examination.

The examples given below in (39) can be regarded as indirect evidence for the asymmetric analysis of (38) (a). The sentences given in (39) (b)-(k) force us to interpret (39) (a) as an asymmetric conjunction in that they force us to interpret the 'and' as some "causal or implicational link" (R. Lakoff). The only type of construction that does not seem to produce a change of meaning is relative clause (391,m). In other words, one may say that when the meanings of the conjoined sentences do not impose an asymmetric interpretation, a conjunction of sentences and the corresponding sentence with a relative clause are equally ambiguous between the symmetric and the asymmetric reading.

(39)

(a) John works at IBM and he plays tennis very well.
(b) John's work at IBM RESULTS in his playing tennis very well.
(c) BECAUSE John works at IBM, he plays tennis very well.
(d) THANKS TO his work at IBM, John plays tennis very well.
(e) John works at IBM IN ORDER TO be good at tennis.
(f) John works at IBM SO THAT he plays tennis very well.
(g) IF John works at IBM, he will be good at tennis.
(h) IF John is to play tennis well, he will have to work at IBM.
(i) John will not be good at tennis UNLESS he works at IBM.
(j) John's work at IBM ENABLED/IS NECESSARY FOR him to play tennis well.
(k) BY working at IBM, John is ABLE to be good at tennis.
(l) John, WHO works at IBM, is good at tennis.
(m) John, WHO is good at tennis, works at IBM.

Let us now return to the field of documentation. The importance of conjunction in this field already appears in Webster's definition of 'documentation' :

(40)

> The assembling, coding and dissemination of recorded knowledge comprehensively treated as an integral procedure utilizing semantics, psychological and mechanical aids, and techniques of reproduction including microcopy for giving documentary information maximum accessibility and usability.

Applying the reversibility test we find that "the assembling, coding and dissemination of recorded knowledge" is an instance of asymmetric conjunction : for instance, "dissemination, coding, and assembling of recorded knowledge" is either unacceptable or different in meaning from the passage of Webster's definition.

However, the reversibility test doesn't always work. In fact, there are cases in which conjunction seems to have the effect of scrambling the expected order of words :

(41)

> A documentation system is defined as a complex pattern of interacting and interdependent processes which facilitates the use of recorded knowledge through its presentation, reproduction, publication, dissemination, acquisition, characterization, storage, and retrieval (J 107).

Because the reversibility test does not always work, it seems that a better procedure for defining asymmetric conjunction (as well as establishing that one has to do with it in a particular sentence) is the one adopted above with Jespersen's example : it consists of showing that asymmetric conjunction is relatable to various other types of constructions.

To illustrate the procedure with another brief example, I suggest that an expression like 'history and development' (J 532) needs to be understood in terms of the following, parallel or relatable expressions : historical development (J 25), history and further development (J 46), history of their development (J 486). Similarly, one can examine the correlation between "the design, operation, and maintenance of the weapons of World War II" (J 828) and, say, the maintenance of weapons designed and operated in World War II. In what follows I shall apply the same technique and present attested examples which have to do with documentation.

In the Janaske corpus, I have found a number of constructions that are relatable to asymmetric conjunction. In (42) (i)-(vi), I present the main types of these constructions in a nutshell, as the constructions that are relatable to the conjunction "the assembling (V1ing), coding (V2ing), and dissemination (V3ing) of knowledge (NP)"(Stockwell et. al. 1968 would write N instead of V, but this is irrelevant to my present purposes)

(42)

(i) The TASK of V1ing AND V2ing AND V3ing NP.
(ii) NP is V1ed (in order) TO be V2ed AND V3ed.
(iii) The V2ing AND V3ing of NP BY V1ing it.
(iv) The V3ing of NP (which has been previously) V1ed AND V2ed.
(v) The V1ing of NP RESULTS IN the V2ing and V3ing of NP.
(vi) (The) V1ing AND (THEN) V2ing AND (THEN) V3ing of NP.

(i) The examples quoted below in (43) (a) and (b) show that when there is a series of verbs such as that represented above as V1, V2, and V3, these verbs or cognate nominals can appear in an NP whose head is a noun such as task, or operation, with this noun in the SINGULAR. The singular appears to be one of the marks by means of which the processes denoted by the verbs are conceived of as a whole, as something global. Other marks having the same value as the singular are adjectives such as 'total'. The singular also appears with the word system as head, as is shown in (43) (c), which can be compared with the part of Webster's definition repeated in (d) and with the equally complex example of (e).

(43)

(a) The task of processing and retrieving information (J 66).
(b) The total storage and retrieval operation (J 970).
(c) a storage-retrieval system (J 978).
(d) The assembling, coding and dissemination of recorded knowledge comprehensively treated as an integral procedure...

(e) Documentation : Complete cycle of information service.
"Documentation is best differentiated from normal library service by the extent to which it is concerned with a complete-cycle service providing information. This cycle involves the identification, recording, organization, storage, recall, conversion into more useful form, synthesis, and dissemination of the intellectual content of print and other recorded materials." (J 890).

(ii) The correlation between asymmetric and and expressions of purpose is well-evidenced in the Janaske corpus. Compare, for instance, "develop AND apply automatic techniques" (J 819) and "the system was developed FOR use" (J 115). The other examples, which are given in (44), have to do with the concept of documentation. The example with "so that... can" (b') is treated as an expression of purpose (rather than result) because it can be paraphrased by 'in order to (that)'.

(44)

(a) Abstracting, coding, AND searching the metallurgical literature (J 508).
(a') the index of Chemical Abstracts could be coded mechanically on a computer FOR LATER searching on a computer (J 239).
(b) storage (= filing) AND retrieval
(b') Most mechanized information retrieval systems depend upon extracting information from documents, processing such information in some manner AND FINALLY placing this information in a file SO THAT the information CAN BE retrieved by machine (J 321).
(c) literature searching AND retrieval (J 1025).
(c') multiple aspect searching FOR information retrieval (J998).
(c'') The essential PURPOSE of literature searching is TO locate those documents... (J 773).
(d) Subject matter analysis AND coding (J 769).
(d') the analysis of this information FOR indexing and cataloging (J 68).

(iii) One further construction which is relatable to asymmetric conjunction is given below in (45) (b) :

(45)

(a) The essential PURPOSE of literature searching it TO locate those documents... (J 773).
(b) papers located BY the direct search of abstracting journals (J 156).
(c) search AND locate

A comparison of (45) (a) and (b) suggests that asymmetric conjunction of the type under investigation is relatable to expressions of purpose as well as to converse instrumental expressions. Further evidence for the correlation between purpose and instrumental expressions can be found in the following, more complex, examples :

(46)

(a) The assembling, coding and dissemination of recorded knowledge comprehensively treated as an integral procedure (...) FOR giving documentary information maximum accessibility and usability (from Webster's definition of documentation).
(b) (a documentation system...) facilitates the use of recorded specialized knowledge THROUGH its (...) storage and retrieval (J 107).

(iv) Another type of construction related to asymmetric conjunction is illustrated in (47) (a) and (b), namely constructions relatable to relative clauses with or without indications of time sequence. (c) illustrates the possibility of such constructions being replaced by an NP with a head noun corresponding to the Ved form ('stored information'/'information STORE').

(47)

(a) storage AND retrieval of information (many examples)
(a') methods for retrieving storED information (J 174)
(a'') retrieving information WHICH is or has been previously stored.
(b) Semi-automatic indexing AND encoding (J 321).
(b') Encoding of information PREVIOUSLY indexED (J 511).
(c) a storage AND search theory (J 250).
(c') search OF an information STORE (J 943).

Also compare (48) (a) with the *Ved* forms underlined in (48) (b), an abstract already quoted in 3.3.2. :

(48)

(a) (Center established for the purpose of...) by *collecting*, *processing*, *storing*, and *retrieving* scientific information (J 1).

(b) Systems and procedures developed for the search, coding and mechanized processing of bibliographic information on thermophysical properties. Methods used by the Thermophysical Properties Research Center for handling *collected bibliographical information* on thermophysical properties are described. Details are given regarding the method of coding abstracts for reproduction on IBM cards, particularly the coding of substances and the system of substance classification and notation used. Procedures used to store the punched card information on magnetic tape are described. Systems of retrieval of *this stored information* are delineated including a description of the organization of *the retrieved bibliography* and of the machine techniques involved. The system described is claimed to be extensible to some other portions of scientific literature. Announced in this paper are the Center's plans to make available an annual index to the literature of thermophysical properties, expected to start publication in 1959. This book-form index -- essentially the output of the Center's retrieval equipment -- is described in prospect as a definitive, *cross-indexed* bibliography of every paper, book, report, or patent containing thermal property information. (J 985).

(v) Yet another type of construction which is relatable to asymmetric conjunction is illustrated in (49). Compare (a) with (b), (c) and (d) :

(49)

(a) Proposes a system providing for a conjoint *search* of separate but correlated record stores AND an optional *printout*... (J 473).

(b) Successful *searches* by this mechanized system RESULT IN the *printout*... (J 517).

(c) *The terminology and coding* that RESULTED IN *selection* of some abstracts not obviously pertinent (J 821).

(d) (services on the part of the library) involve a regular *scrutiny* of ... periodicals *with* [= AND] CONSEQUENT *indexing* and *distribution* of the RESULTING information (J 446).

The following example illustrates an even more complex situation, where the expression relatable to result is embedded in a manner NP ('*in an organized manner*'):

(50)

Storage of this information *in an organized manner* that PERMITS [= RESULTS IN] rapid *retrieval* (J 494).

(vi) Next to instrumental, purpose, result and consequence expressions another type of construction relatable to asymmetric '*and*' can be called *time sequence*. It has been examined by Robin Lakoff in the form '*and then*', but this form is by no means the only one. Besides, *and*-conjunction, is not the only construction in which indications of time sequence can occur, as already appeared from some examples quoted above and repeated below. The time factor can also be as it were factored out and made into an NP, as is shown in (51) (f) and (g).

(51)

(a) *Encoding* of information PREVIOUSLY *classified* (J 651).

(b) Most mechanized information retrieval systems depend upon *extracting* information from documents, *processing* such information in some manner, AND FINALLY *placing* this information *in a file* so that the information can be retrieved by machine (J 321).

(c) The index of Chemical Abstracts could be *coded* mechanically on a computer FOR LATER *searching* on a computer (J 239).

(d) (possible) for the abstracts THEN to be automatically *encoded* FOR SUBSEQUENT *searching* (J 656).

(e) (documentation is defined as) a technique for *communication* with unknown persons *IN THE INDEFINITE FUTURE* (...) the *flow* of information to the unknown user *IN THE FUTURE* (J 81).

(f) the TIME gap between the generating of information and its availability (J 350).
(g) Shortening the TIME lag between original discovery and engineering application (J 987).

In the next chapter (3.4.), I shall return to the problem of asymmetric conjunction. Until then I shall stick to the notation introduced above in (42).

3.3.4. *Lexical presupposition and Lyons's implication.*

About her examples of asymmetric conjunction, Robin Lakoff claims that

> Taken out of context, the conjuncts would not retain this causal or implicational link, so that part of the meaning of the sentence would be lost - the idea that each one led up to the next (Robin Lakoff 1969, 23).

As pointed out in 3.1.4., I suggest that this is only partly true, and I wish to argue in this section that asymmetric conjunction in the field of documentation displays *two* types of presuppositions. One is the type of *lexical* presupposition which has been mostly discussed by Fillmore. In this type, the presuppositions are statable as part of the properties of lexical items, such as verbs, and the presuppositions continue to hold when a sentence with the verb in question as main verb is used in isolation. Fillmore's analysis of '*borrow*' is a good example : with or without context, you cannot help associating the presupposition (*C had B before time T*, with a sentence '*A borrowed B from C at time T*' (Fillmore 1968c, 52). Similarly, it is a property of a predicate like '*retrieve*' that you can only '*retrieve*' something which is lost, hidden, which you do not possess, etc. Or take the pair '*input-output*'. I believe that it is a property of the WORD '*output*' that it presupposes '*input*'. I give this example because a sentence of the Janaske corpus which is relatable to '*input-output*' happens to be the only place at which the verb '*presuppose*' occurs in the whole corpus : "To *get* relevant and valid information *out* of a machine *presupposes* that it has been *put in* with a most exacting pattern of forethought" (J 179) (cp. '*throughput*' which, I gather, has crept into the computer jargon).

Robin Lakoff's point is only applicable to what can be called non-lexical or situational presupposition, which can be illustrated as follows. Imagine a situation in which John usually performs the following actions one after another : he gets up, then washes, dresses, has breakfast, and goes to school. If John is in bed, his mother can call him by saying "*John, it's time to*—" + ANY of the above sentences and any of these can be said to presuppose all the others. But such a presupposition cannot be regarded as a property of the verbs in question : people can have breakfast in bed, at school, at noon, etc.

In the present section, I shall represent the conceptual field of documentation in a fashion similar to that adopted in the preceding section when "the assembling, coding, and dissemination of knowledge" was symbolized as "*V1ing* AND *V2ing* AND *V3ing* of NP". On this basis I propose to define *Vlast* as the last *V* in a given sequence of *V*'s that are relatable to each other by asymmetric conjunction. Thus "*dissemination*" is *Vlast* in the above example. If '*use*' is added as *V4* to the above ("the assembling, coding, dissemination and use of knowledge"), it becomes *Vlast*. Furthermore a situation in which, say, a *V1* presupposes a *V2* will be described as '*forward presupposition*' and the converse situation as '*backward presupposition*'. One everyday example of forward presupposition is the use of GO OUT in the meaning of "mix in society; attend social functions, etc. : *She still goes out a great deal, even at seventy-five*" (Hornby). In all this discussion, then, I shall go on speaking — as Fillmore has often done — of 'presupposition of verbs' as a convenient abbreviation for 'presupposed belief conditions for an appropriate use of sentences containing these verbs as main verbs - or cognate nominal constructions with the cognate nominals acting like main verbs in a sentence' (cp. Fillmore 1970b).

My main purpose in proposing such concepts as Vlast is that of explaining the use of single V's which, as far as their meaning is concerned, appear as abbreviations of string of conjoined V's. Compare, for instance, the frequent phrase "information storage and retrieval" and the abbreviation to "retrieval" in "On retrieval system theory" (J 1044). I shall discuss successively :

(i) presuppositions associated with Vlast;
(ii) forward and backward presuppositions;
(iii) I shall then turn to problems associated with Lyons's implication.

A more formal treatment of some of these questions will be presented in the next chapter (3.4.).

(i) One example of Vlast is, I believe, the word 'documentation', and the cognate verb 'document', one of the definitions of which is "to supply with documents" (Webster's). From the following abstract, for instance, I suggest that it is possible to reconstruct an asymmetric conjunction which would include among others "cover" ("literature"), 'process' (with "mechanical aids"), 'search' (on the basis of "searcher"), and "document". Yet only documentation (in the title) and "document- " (in sentence one) are mentioned at the beginning. What they presuppose, however, is ASSERTED by the rest of the text. A similar example with 'dissemination' is given in (53).

(52)

(a) Problems of documentation of the literature of atomic energy.
The problems of documenting the literature of atomic energy are many. The volume of literature to be covered is large, it draws on a wide range of subjects, security difficulties place barriers against the searcher and cause duplication of effort. Mechanical aids are desirable. The status of the documentalist should be improved, since it is difficult to draw the line between his responsibilities and that of the scientist (J 371).

(b) Proposed analysis. "Documenting the literature of atomic energy" presupposes what precedes in the conjunction "cover, process, search and document the literature of atomic energy", and it can be regarded as an abbreviation of this conjunction.

(53)

(a) The dissemination of the knowledge of Soviet scientific work in Western countries.
Paper devoted to discussion of sources of Russian scientific information as well as the means of obtaining sources specific to each. Attention is given to available as well as needed areas of abstracting and indexing services. The "language barrier" and consequent role of translation of Soviet periodicals together with current enterprise in this field is discussed. Data are presented in summary form on the proportion of the published scientific literature from the Soviet Union currently available in England. (J 945).

(b) Proposed analysis. "The dissemination of..." presupposes what precedes in the conjunction "abstracting, indexing, translation, and dissemination of..." (or possibly : "translation, abstracting, ...") and it can be regarded as an abbreviation of this conjunction.

By similar reasoning, I suggest that one can account for an expression 'documentation center'. A documentation center does not merely 'supply' people with documents. One is also tempted to account for expressions like 'information center' or 'information system' in this fashion (an alternative explanation is presented below). Evidence for this is the following attested (and, to me, slightly odd) sentence in which 'communicate' seems to function as V1 and 'inform' as V2 : "The objective of scientific communication is to inform" (J 247; compare: 'communicate and inform', not attested).

Other instances of Vlast are underlined in the following sentences. Some are conceptually equivalent to 'documentation' and some are actually definitions of the concept:

(54)

(a) Finding what's known. Information retrieval techniques to make the vast store of knowledge conveniently accessible... the intellectual job of matching what's known and what's wanted (J 407).
(b) Documentation is defined as a technique for communication ... (J 81).
(c) Scientific documentation -- the operation of bringing the facts elucidated by scientific research from those who produce them to those who can make use of them -- (J 97).
(d) The problem of bridging the gap between the individual who wants the information and the records containing the information (J 205).
(e) The basic problem is to increase the mental contact between the reader and the information stored (J 474).
(f) Keeping research in contact with the literature
(g) The man-document communication problem (J 1110).
(h) The problem of getting information into the hands of the scientist who needs it (J 418).

(ii) Let us now consider forward and backward presuppositions. In order to understand the examples presented below, one must bear in mind that punched-cards in documentation are strictly speaking a storage medium. In other words, in a conjunction such as "collect (V1), abstract (V2), code (V3), store (V4), retrieve (V5) and disseminate (V6)". punched-cards would normally be associated with V4 as in, say, 'stored on punched-cards'. This, however, is not necessarily so. In the following examples, 'punched-cards' are associated with 'coding' (V3), 'collecting' (V1), and 'abstracting' (V3), which I would regard as V's that are PRESUPPOSED by 'stored on punched-cards'. Similarly, given the conjunction "collect (V1) and handle (V2) information", note the shift in the same abstract from V2 to V1 exemplified in (55) (c) :

(55)

(a) Coding of Hammett RHO-values on punched cards. McBee Keysort cards are used to collect data containing application of the quantitative relations between the structure and the reactivity of organic compounds by the Hammett equation. (J 469).

(b) The use of four-hole randomly punched cards for abstracting publications and reports into IBM cards. Coding of abstract information on IBM cards is limited by the 80-column capacity of the cards. A random code of two, three, or four holes successively increases the capacity to code categories of information and still retains space on the card for coding other identifying information on the referenced publication or report. The code, storage, and retrieval processes are described. (J 904).

(c) Information handling in a large information system. Concerns research into the collection of information on chemical compounds found in edible plants. The study was conducted at the Low Temperature Station for Research in Biochemistry and Biophysics, University of Cambridge, England. This paper is a description of the resulting system, and a report of variuus problems encountered in its development (J 167).

Lastly, forward and backward presupposition account for the possibility of having expressions consisting of V's that are non-contiguous in the asymmetric conjunction by means of which I propose to represent the concept of documentation. The expressions have the same global meaning as 'documentation' by virtue of forward and backward presupposition. Thus, "organization and dissemination" in the following example is equivalent to 'documentation' and can be said to stand for something like 'collection, organization, storage, retrieval, and dissemination'; I shall attempt to clarify what I mean by 'something like' at the end of this section in the light of what Lyons calls implication :

(56)

It is concluded that the organization and dissemination of scientific information is a professional activity... (J 967).

(iii) In the last published formulation with which I am acquainted, Lyons illustrates his proposals about *implication* rules with the sentence '*I bought some flowers*'. He suggests that this sentence *implies* a "disjunction" or a conjunction (actually, he speaks of 'co-ordination' - between inverted commas) of sentences with hyponyms of '*some flowers*'. This can be written as : '*I bought some flowers*' IMPLIES '*I bought some tulips*' AND/OR '*I bought some roses*', etc. (Lyons 1968, 455). Just a few pages before the passage just referred to, he defines implication in terms of "*implicit* assertion and denial" (*op. cit.*, 445). This, it seems to me, is a more fortunate characterization than the other formulation which I have illustrated by means of AND/OR. I suggest that in the above example the AND can be equated with "(implicit) *assertion*", and the OR with "(implicit) *denial*", and that this OR can be replaced by AND NOT. Sticking to the kind of informal representation adopted by Lyons (a more formal symbolisation would require more knowledge of negation than is, I think, currently available), the above example can be written as in (57) :

(57)

I bought some flowers IMPLIES
AND [± NOT (I bought some tulips)]
AND [± NOT (I bought some roses)]
etc.

Obviously, at least *one* ± NOT in (57) must be -NOT. Moreover, the implication is *bilateral* in the above example. Lastly, note that the formulation of (57) captures the *indeterminacy* of implication in the same way as does the formulation with AND/OR. (on the reasons for positing AND in the first conjunct and an *and*-deletion rule, see Lakoff and Peters 1969, 114 fn. 2). On the basis of Leech 1969 (35-38), similar rules can be written for an implication relation between sentences in which the superordinate term and the corresponding hyponyms are predicates. This is what we need here, for sentences belonging to the conceptual field of documentation. Provisionally, I ignore the distinction - as does Lyons - between symmetric and asymmetric 'and'. Now consider the following translation of the main headings of the Gardin-Lévy concordances (cp. an almost identical translation given in Appendix 2) :

(58)

1. Scientific and technical information : generalities.
2. Professional problems.
3. Information science.
4. Related sciences.
5. Networks of scientific and technical information.
6. Scientific and technical information institutions.
7. Functioning of scientific and technical information networks.
8. Sources of information.
9. Techniques of reproduction.
10. Information handling : generalities.
11. Collection of information.
12. Documentary analysis : generalities.
13. Cataloguing.
14. Abstracting.
15. Synthesis.
16. Classification and indexing.
17. Extracting, tabulation and index production.
18. Translating.
19. Coding.
20. Storing.
21. Searching.
22. Dissemination.
23. Machines and equipment.
24. Terminology.
25. Standards.

Note that the headings contained in the above boxes can be conjoined. One can say, for instance :

(59)

(a) information handling consists of collecting, cataloging, abstracting, synthesizing, classifying, and indexing, extracting, translating, coding, storing, searching, and disseminating scientific information.

(b) documentary analysis consists of cataloguing, abstracting, synthesizing, classifying and indexing, extracting, translating, coding and storing scientific information.

(59) (a) and (b) can be rewritten as implication rules as in (60) :

(60)

(a) handling information IMPLIES
AND [± NOT (collecting information)]
AND [± NOT (cataloguing information)]
AND [± NOT (abstracting information)]
AND [± NOT (synthesizing information)]
AND [± NOT (indexing information)]
AND [± NOT (extracting information)]
AND [± NOT (translating information)]
AND [± NOT (coding information)]
AND [± NOT (storing information)]
AND [± NOT (searching information)]
AND [± NOT (disseminating information)]

(b) analyzing information IMPLIES
AND [± NOT (cataloguing information)]
AND [± NOT (abstracting information)]
AND [± NOT (synthesizing information)]
AND [± NOT (indexing information)]
AND [± NOT (extracting information)]
AND [± NOT (translating information)]
AND [± NOT (coding information)]
AND [± NOT (storing information)]

(c) = (a), with the replacement of the appropriate items by 'analyzing information' (b) :
handling information IMPLIES
AND [± NOT (collecting information)]
AND [± NOT (analyzing information)]
AND [± NOT (searching information)]
AND [± NOT (disseminating information)]

The implication relation in (60) (a) and (b) can be regarded as bilateral. Now, the ± NOT's in the above rules are not quite correct. First, like in the example borrowed from Lyons, there is an obvious logical reason for imposing that at least one NOT should be marked minus. Second, and also for logical reasons, the 1st sentence in (60) (a) must be -NOT: 'Collecting information' must be -NOT (i.e. assertive), because you must 'collect information' in order to be able to 'disseminate information'. This would be statable in case theory by saying that some institution must be the Goal of 'collecting information' in order to be the Source of 'disseminating information'. Third, there are pragmatic reasons which only the expert of the field could state for deciding that certain operations of documentation are necessary, while others are not. Since the Gardin-Lévy concordance is not specific about this, I shall just assume in what follows that 'abstracting', 'synthesis', 'translating', and 'coding' are optional, and that the other operations are necessary. Also for pragmatic reasons, an operation such as 'translating' may be necessary : for instance, in the abstract quoted above in (53), about "the dissemination of the knowledge of Soviet scientific work in Western countries" (J 945).

I suggest that lexical presupposition (as in Fillmore's 'borrow' sentence) corresponds to what I call logically - based implication, while the other type of presupposition (e.g. the relation between "the police arrived" and "everybody swallowed their cigarettes" in Robin Lakoff's example) would correspond to my pragmatically-based implication. Ignoring the uncertainties just noted, implication rules of the type given in (60) for the metalanguage can be regarded as necessarily 'right' or 'correct'.

But one cannot say that they are true. On the basis of a recent discussion by Bierwisch, we can say that implication rules for the metalanguage cannot be assigned a truth-value because they are stipulative definitions :

> A stipulative definition stipulate that, whatever the word may mean in other communications or even in earlier parts of this communication, it is for the rest of this communication to be taken as having no meaning whatever except the one now stipulated. Any previous meanings are thereby abolished for the remainder of this communication (Robison 1950 quoted in Bierwisch 1969, 77).

In the rest of this section, I wish to mention three further points, which concern the relations between object-language and metalanguage in this thesis. First, the headings of the metalanguage are by definition NOT subject to presupposition as are the corresponding verbs in the object-language. This is also due to the stipulative character of the metalanguage. To take just one example, a heading like DISSEMINATION (Nr. 22 in the Gardin-Lévy concordance) is, by definition, understood as 'dissemination' in the strict or narrow sense. It is by virtue of this that the metalanguage can provide the semantic PRIMES for the present investigation. As will be suggested, by my third point below, I cannot think of another way of defining semantic primes for this study.

My second point has to do with hesitations which I have experienced on several occasions when indexing abstracts of the Janaske bibliography. These hesitations can be explained by returning to an everyday example with to GO OUT. Suppose a teenager tells his parents : 'I am going out'. This is ambiguous, depending on whether or not you add various presuppositions (such as 'to attend a party') to the meaning of, say, 'leaving the house'. Similarly, in the conceptual field of documentation, a Vlast such as, say, 'dissemination' always presupposes (at least some of) the other V's.

Thus I would say that the first abstract quoted below (in 61a) presents such a problem. While it is clear that its central topic is DISSEMINATING ("presenting", "disseminating") at least one presupposition shows up in the text, namely in "classification number". In the abstract of (61) (b), on the other hand, DISSEMINATING can be regarded as the only topic. This is no doubt in part due to the fact that no mention is made of processes that 'precede' dissemination, and to the fact that the Vlast is not "disseminate" but "provide" : "disseminating ... literature to the researcher... provide the user with ..."

(61)

(a) New methods for presenting bibliographical information in the U.S.S.R.
Two methods of disseminating scientific technical articles are described as used by the State Public Scientific and Technical Library attached to the Siberian Department of the USSR Academy of Sciences. The first method, which is suitable only for individually prepared bibliographies or other cases requiring only a very few copies, involves the use of pockets the size and shape of catalog cards into which microfilm copies of articles are inserted. The bibliographic description, classification number and card number are printed on one side of the pocket, and the serial and classification numbers are shown on the first frame of microfilm. Production costs are about two rubles a card. For current information on a large scale, microcards are used. Since the average article is only four pages in length, a modified type of card is prepared which reduces the original only five or six times. The cards can, therefore, be read with very simple magnifying glasses. Bibliographic information is photomechanically printed on a catalog card, on the back of which is pasted the photographic reproduction of the original. At the beginning of 1960 the Library opened a subscription list and inaugurated a pilot service of this kind for mechanical engineering and plastics. (J 551).

(b) Sassif (Self adjusting system of scientific information flow).
Describes a system of disseminating newly published scientific literature to the researcher. This system will provide the user with (1) originals of all

> articles clearly of interest to him, (2) summaries of articles not in the scope of marginal interest to him, (3) summaries of articles not in the scope of the user's present range of interests to titillate his interests and relieve him of the burden of scanning a large body of literature of marginal interest. (J 141).

In the cases where, as in (61 a), 'dissemination' has or may have a global meaning, I would suggest that it should be generated by implication rules of the type illustrated in (60) from an OBJECT-LANGUAGE sentence with a superordinate verb (e.g. 'information handling'). In the other case (61b), the underlying sentence would have as its verb 'disseminate' and rules of presupposition would take over to state that, say, what has the meaning of "dissemination" proper presupposes the processes that precede in the field of documentation.

My third and last point is the following. One of the major difficulties in dealing with the vocabulary of the Janaske corpus (i.e. the object-language under investigation) is that superficially different lexical items can correspond to the same heading of the metalanguage. Different lexical items with the same meaning commonly occur in the same abstract : for instance, "information filing and retrieval = arranging and finding" (J 60), "presenting = disseminating information" (J 551), "data banking = information storage and retrieval" (J 334). A generative semanticist might argue that lexical decomposition would be able to display, and thus predict, such equivalences between superficially different predicates. Until the point can be demonstrated, one reason for doubting that such a solution is achievable is that even with such superordinate predicates as "handling", it may be necessary to resort to a stipulative (i.e. linguistically unmotivated) definition. An example is given below, in (62) (a). In spite of the occurrence of "handling" in the abstract, I believe that this text should be indexed by the terms

ANALYSIS (Nr. 12) and SEARCHING (Nr. 21) of the Gardin-Lévy concordance rather than by HANDLING (Nr. 10). In (62) (b), I have tabulated the object-language expressions and the corresponding headings of the classification. Implication rules between the various sentences tabulated are statable on the basis of the fact (to be discussed in 3.5.) that in many cases 'using a method (system, machine, etc.) to do something' is equivalent to 'doing something with the method (system,etc. in question)'.

(62)

(a) Methods used by the Thermophysical Properties Research Center for handling collected bibliographical information on thermophysical properties are described. Details are given regarding the method of coding abstracts for reproduction on IBM cards, particularly the coding of substances and the system of substance classification and notation used. Procedures used to store the punched card information on magnetic tape are described. Systems of retrieval of this stored information are delineated including a description of the organization of the retrieved bibliography and of the machine techniques involved. The system described is claimed to be extensible to some other portions of scientific literature. Announced in this paper are the Center's plans to make available an annual index to the literature of thermophysical properties, expected to start publication in 1959. This book-form index -- essentially the output of the Center's retrieval equipment -- is described in prospect as a definitive, cross-indexed bibliography of every paper, book, report, or patent containing thermal property information. (J 985).

(b)

	Object-language	Metalanguage
a	handling information which implies b - d	ANALYSIS, which implies b - c
b	coding classification notation	CODING ? CLASSIFICATION CODING
c	store	STORING
d	retrieval	(SEARCHING : see table 63 , below)

I now wish to end this section by presenting a table which gives some of the verbs, verbal expressions and cognate nominals found in the Janaske corpus that correspond to the headings of the Gardin-Lévy classification. Whenever it was possible, the order in which they are listed is the same as that adopted by Gardin-Lévy for their main entries ("groups") and these entries are given between brackets and capitalized. Some co-constituents of the words listed are given when necessary, for instance for some technical terms. A ± sign is added before a *V* of the Gardin-Lévy classification when I assume that the process or operation in question is optional. As will be noted, the same object-language word can appear under various headings. Also note that various lists have no corresponding descriptor in the "groups" of the Gardin-Lévy concordance which have been considered in this section. The typical Object of all the *V*'s listed is *information*, though it is by no means the only one. The typical Agent of *V1* to *V12* is some kind of institution, or some officer.

(63)

V1 (COLLECTION of information)
acquisition, *assemble*, *collect*, *gather*.

V2 (CATALOGUING)
catalog.

± V3 (ABSTRACTING)
abstract (texts) *condense*, *make abstracts*, *summarize*.

± V4 (SYNTHESIS)
prepare (literature search) *reports*, *analytical* (and *critical*) (research) *reviews*, (literature) *surveys*.

V5 (CLASSIFICATION and INDEXING)
analyze, *catalog*, *categorize*, *classify*, *code*, *correlate*, *cross-reference*, *describe* (documents), *express... in a neat fashion*, *index*, *order*, *organize*, *reduce...to a standard form*, *represent* (content), *produce* classification information.

V6 (EXTRACTING)
auto-encode, auto-index (or self-), extract, index, produce a bibliography (a concordance, a KWIC-index).

± V7 (TRANSLATING)
translate.

± V8 (CODING)
abstract (into punched-cards) (?) code, notation, translate (into punched-cards) (?)

V9 (STORING)
arrange (in a file), bank, code (on punched-cards) (?), file, place (in a store or file), store.

V10 (SEARCHING)
explore, interrogate, produce (a search), scan, search, sort (cp. "diminishing false drops and blank sorts", J 413).

V11
find, locate, retrieve, select.

V12 (a) (DISSEMINATING)
display, (selective) dissemination, present.

(b) bring (information to ssientists) communicate, convey, display, distribute, disseminate, document, impart, inform, get (information) into the hands of, keep ... informed, present, provide, sell, serve, service.

(c) (+ need for information, etc., as Object.)
fulfil, satisfy, serve.

(d) (+ information as Object.)
make available, accessible, offer, provide.

V13 :(with scientist as Agent or Dative, and Goal.)
borrow, collect, gather.

V14 :(with scientist as Agent or Dative.)
have access to, accessible, available, control, find, get, keep informed, keep up with, learn of, obtain.

V15 :(with scientist as Agent.)
use, read (document).

In view of what precedes, I would argue that the linguist can only resort to data collection and to a metalanguage if he wishes to set up a canonical list of the predicates of fields such as documentation. In other words, I have the feeling that, considering the complexities of such a field, any linguistic theory currently available is unable to predict the wealth of *lexical* possibilities that would need to be predicted. Instructive as they may be, monographs of the type Fillmore has presented on small sets of verbs ('Hitting' and 'Breaking', 1967; 'Verbs of Judging', 1969b) do not provide theoretical tools powerful enough for dealing with a field like documentation. Besides, even if more sophisticated theories were available, I believe that semantic *primes* that are relevant to *pragmatic competence* in a field like documentation would still have to be given by a metalanguage set up *a priori* by *experts*, in the form of *stipulative* definitions.

3.4. ASYMMETRIC CONJUNCTION AND CASE.

3.4.1. Towards a case representation of asymmetric conjunction.

In this chapter, I wish to present an analysis of asymmetric conjunctions of sentences and relatable constructions in terms of an extension of case theory. In the present section, I shall present the type of representation which I believe to be needed. Before doing this, I shall consider a fairly simple example of asymmetric conjunction in order to identify the types of constructions that are relatable to it. I realize that some of the paraphrases presented below may sound a bit odd. However , I think that they are logically possible and that a general methodological principle of TG theory, which I believe to be most fruitful and revealing, justifies an examination of all the possible constructions relatable to asymmetric conjunction. According to this principle, sentences are derived from their most complete representations or, to put it differently, the paraphrases of a sentence that most explicitly reveal the relations between the sentence constituents are considered to be closer to deep structure than the less explicit paraphrases.

In 3.3.3., I have pointed out that next to conjunction ('storage AND retrieval of information'), various types of constructions can serve to express the concept of documentation or relatable concepts : for instance, expressions of purpose (store information IN ORDER TO retrieve it), instrumental expressions (retrieve information BY storing it), relative clauses and transformationally relatable constructions (retrieval of the storED information) and expressions of result (the storage of information RESULTS in its retrieval).

In order to carry my discussion of asymmetric conjunction a step further I shall go out from just one example which is given below in (1), and which is a simplified version of a sentence occurring in J 1 :

(1)

> The Center will contribute to the development of science by collecting, processing, storing, and retrieving scientific information.

The following points can be made about this sentence.

(i) The gerunds in (1) can be conjoined by AND BY :

(2)

> The Center will contribute to the development of science BY collecting AND BY processing AND BY storing AND BY retrieving scientific information.

(ii) (1) can be converted into the conjunction given in (3) :

(3)

> The Center will collect, process, store and retrieve scientific information and contribute to the development of science.

(iii) (1) can be converted into a sentence containing an expression of purpose :

(4)

> The Center will collect, process, store and retrieve scientific information IN ORDER TO contribute to the development of science.

(iv) (1) can be converted into a sentence containing both an 'instrumental' expression and an expression of purpose, as in (5) (a) which is modelled after the attested sentence quoted in (5) (b) :

(5)

> (a) The Center will carry out its PURPOSE to contribute to the development of science BY collecting, processing, storing, and retrieving scientific information.
> (b) Aslib carries out its purpose to develop the practice of special librarianship (...) by means of programmes of education and research, (1) by educating..., (2) helping... (J 1102).

Furthermore, (1) can be converted into a sentence in which all the verbs depend on "purpose" :

(6)

The Center will carry out its PURPOSE to collect, process, store, and retrieve scientific information and to contribute to the development of science.

To me, however, a sentence such as (6) seems to be truncated version of the type of sentence illustrated above in (5) in that some 'instrumental expression (by ...) seems to be implicit in it.

(v) A purpose expression can be used inside an 'instrumental' expression (7) (a), and an 'instrumental' expression can occur inside a purpose expression (7) (b) :

(7)

(a) The Center will contribute to the development of science by collecting information in order to process, to store, and to retrieve it.
(b) The Center will collect information in order to contribute to the development of science by processing, storing, and retrieving the information.

(vi) (1) can be converted into a sentence with "result" as its main verb :

(8)

The Center's collecting, processing, storing and retrieving of scientific information will RESULT in the Center's contributing to the development of science.

(vii) Relative clauses or transformationally related constructions can be introduced into (1) :

(9)

The Center will contribute to the development of science by collecting information, by processing the collected information, by storing the processed information, and by retrieving the stored information.

(viii) Conjunction shows up in all the sentences just given (1 to 9) in the form of and or of a comma, or of both.

In all the linguistic literature with which I am acquainted, I have found no rule or system of rules that would be able to generate semantic descriptions for the sentences just given. Typically, Ross (1967, 169) does not attempt to characterize the purposive relationship which he believes should hold between conjoined sentences such as (10) (a) for them to be convertible into a noun-phrase with relative clause such as (10) (b) :

(10)

(a) I went to the store and bought some whisky.
(b) The whisky I went to the store and bought.

Now, what strikes me about the sentences given in this section is this :

(i) It seems that they fall basically into two types of surface constructions. In the first type, we have just conjunction of VP's : The Center VP1 and VP2 and VP3 etc. (as in 3). The second type consists of a sentence in which we have both conjunction and some other type of relation (e.g. purpose), and the two types of construction seem to be complementary : for instance, The Center VP1 IN ORDER TO VP2 AND TO VP3.

(ii) The sentences of the second type can in turn be subdivided into two types, according to the nature of their main verbs. In the first subtype, the main verb can be described semantically as an abstract predicate : for instance, The purpose of— is to— by— [illegible] — results in—. In the second subtype, the main verb is one of those verbs described in 3.3.4. as V1, V2, etc. : for instance, 'the Center V1s... in order to V2... and ...' or 'the Center V2s... by V1ing...'.

(iii) In both sentence types mentioned in (ii), there always seems to be a division into two parts. The clearest examples are structures of the type 'x Vs this (±and...) IN ORDER TO V this (± and...)' or of the type 'x Vs this (±and.. BY Ving this (±and...)' , where IN ORDER TO and BY mark the partition.

If the above observations are correct, the fundamental problem lies, I think, in adapting the well-known rule schema *S—>C S x* (sentence rewritten as a conjunction of any number of sentences) in such a way that the relatedness between conjunctions of sentences and other, partly equivalent, sentence structures can be captured.

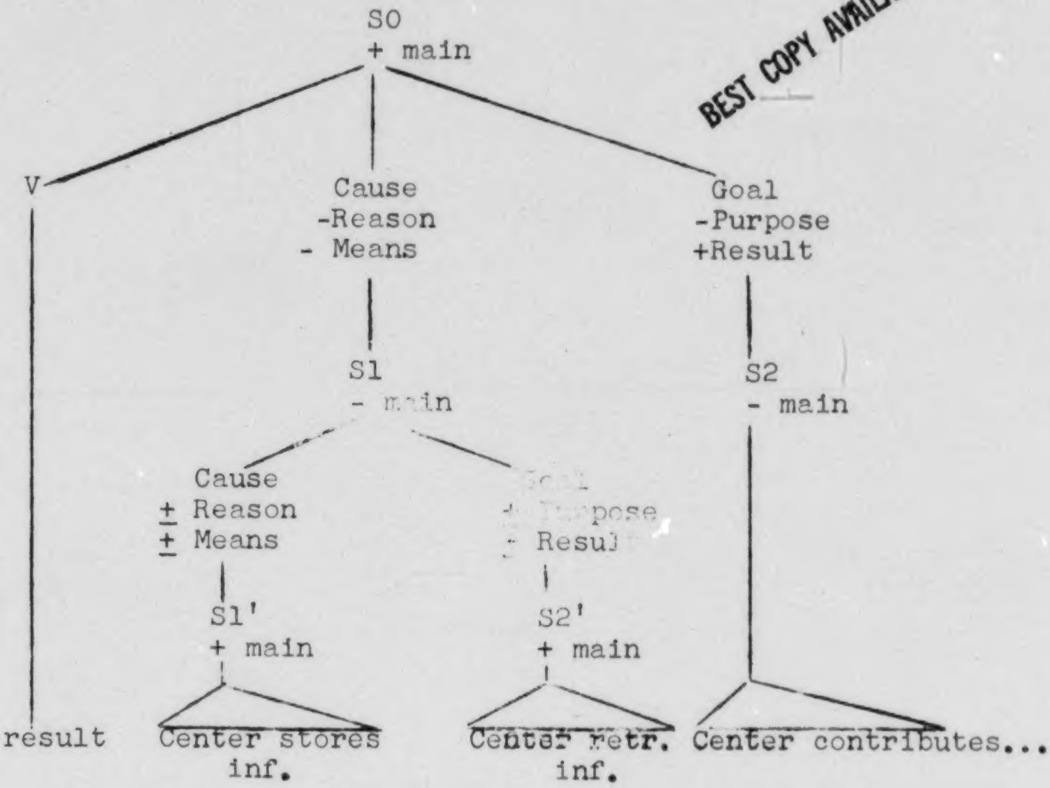
The solution I propose is the following. It consists of resorting to a form of representation in which a sentence (S0) is rewritten as a pair of case labels which themselves are rewritten as a pair of sentences (S1 and S2). The system is recursive in that it allows for S1 or S2 or both to be rewritten as a pair of sentences (S1', S2') and for these sentences themselves to be rewritten (as S1'', S2''), etc. Following a recent proposal by Fillmore (1970b) S1 and S2 are rewritten directly from case labels without any intermediary rewritings (such as the case marker *K* + *NP* in Fillmore 1968; moreover, as stated in 3.1.1., I shall write S for what Stockwell *et al.* represent as NOM and rewrite as N + Cases : Stockwell *et al.* 1968, PS rule 7, page 34). The case labels which I propose are *Cause* for S1, and *Goal* for S2, and are intended to represent the fact that the event or state of affairs described in S1 is regarded as a necessary logical condition for the event described in S2 to be possible. *Cause* is a generalization of a "role" label proposed by Langendoen. He argues that case (or "role") theory needs to state a distinction between two situations. When an "instrument-like expression" is used in a sentence with an Agent expressed or understood, Langendoen proposes to analyze the expression as Instrument. When, on the other hand, an instrument-like expression is "used in a sentence without an understood Agent", he proposes to analyze it as Cause : for instance, "loss of blood" in "*Loss of blood* killed the victim". Langendoen, I think correctly, points out that a sentence "Poison killed the victim" is ambiguous with respect to the absence or presence of an understood Agent, and he proposes to capture this by having a role or case structure consisting of either Instrument and Agent or just Cause (Langendoen 1970, 74-5). I borrow the Goal label from Fillmore who has recently proposed to generalize the definition of the Goal case for it to include his former Result case. Moreover, I propose that either S0 alone, or S1, or S2, or both, can be marked + main, to represent the fact that any of the sentences in question can be selected as the main sentence (in a paper which has not been available to me, Postal makes use of a "-main" convention to derive restrictive relative clauses : Postal 1967, in Annamalai 1970, 140).

In addition to the + main-convention, I propose a three-valued system of features which are attached to the case labels : for instance, the features [+ Reason] and [+ Means] can be attached to the Cause label, and features such as [+ Purpose] and [-Result] to the Goal label. I suggest that the value ±, standing for 'irrelevant', is applicable to conjoined constructions, since such concepts as result and purpose are left unexpressed in conjunctions. To sum up, the notation system proposed is intended to symbolize both the similarities and differences between asymmetrically conjoined sentences and the various relatable constructions as illustrated at the beginning of this section and discussed in 3.3.3.

I shall now illustrate the system I propose by presenting a few types of situations that are predictable on the basis of such a system. Analyses of a number of attested examples will be presented later, in sections 3.4.3. and 3.4.4. In these analyses it will be necessary to add a few features to those mentioned so far. In the examples I present below, I assume the correctness of the "conjunction reduction" hypothesis (Stockwell _et al._ 1968, 323). What will be said in the next section on projection and relative clauses (3.4.2.) can serve as an argument for this assumption.

(i) In the following sentence (11), S0 is marked _+ main_ because the sentence has an abstract predicate ('_result in_') as its main verb. The Cause-clause (S1) is the subject in the surface form of the sentence, as is "_Loss of blood_" in Langendoen's sentence "Loss of blood killed the victim". I have attached the negative feature specifications [-Means] and [-Reason] to S1 and [-Purpose] to S2, because it seems to me that no such concepts are involved. Even though it is redundant with the main verb, a feature [+ Result] is attached to S2, because such a feature is needed elsewhere. S1' and S2' are marked _+ main_ to represent the fact that, since they are conjoined, they are on the same footing.

(11)

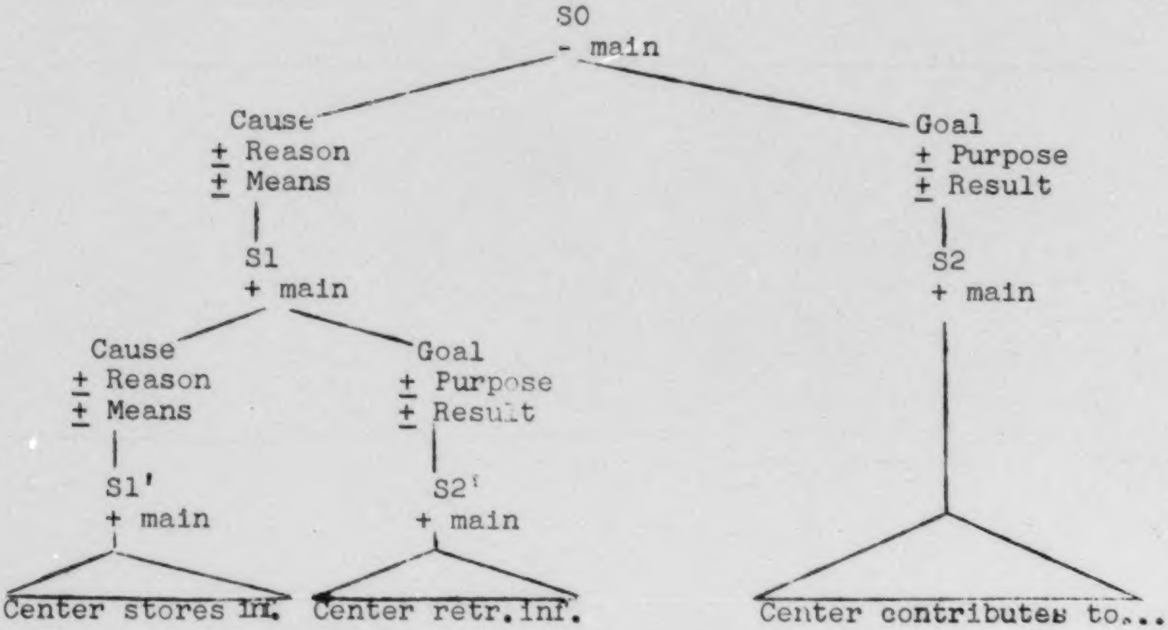

S0
+ main
V
Cause
-Reason
- Means
Goal
-Purpose
+Result
S1
- main
S2
- main
Cause
± Reason
± Means
Goal
± Purpose
± Result
S1'
+ main
S2'
+ main
result
Center stores inf.
Center retr. inf.
Center contributes...

Example : The Center's storage and retrieval of information results in the Center's contributing to the development of science.

Cp. : The Doctor's speedy arrival and careful examination of the patient resulted in her speedy recovery.

(ii) In sentence conjunction, I propose to mark both S1 and S2 as + main. In (12), all the other feature specifications are marked ± : this is how I propose to represent the fact pointed out earlier that conjunction blurs or obscures relations that are expressed in other, parallel, constructions. I suggest, however, that this need not always be the case in sentence conjunction or coordination. Thus, S2 would be marked [+ Result] to represent the following sentence (cp. the second sentence given below in 12) : 'The doctor arrived rapidly and examined the patient very carefully; (and) as a result, she soon recovered'.

(12)

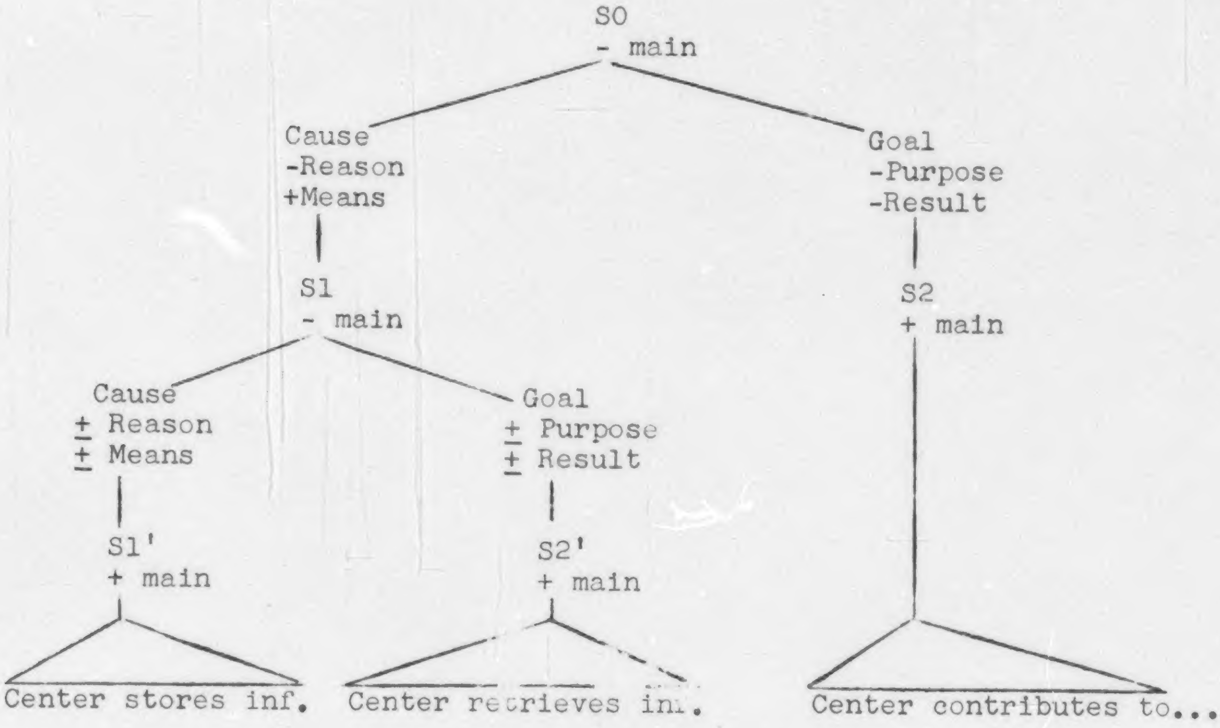

S0
- main
Cause
± Reason
± Means
Goal
± Purpose
± Result
S1
+ main
S2
+ main
Cause
± Reason
± Means
Goal
± Purpose
± Result
S1'
+ main
S2'
+ main
Center stores inf.
Center retr.inf.
Center contributes to...

Example : The Center stores and retrieves information and contributes to the development of science.

Cp. : The Doctor arrived rapidly and examined the patient very carefully, and she soon recovered.

(iii) The representation which I propose for by-expressions which Fillmore 1970b would represent as Instruments is given below in (13). The sentence with the main verb is marked + main and the by-expression is assigned the feature [+ Means], for lack of any better name. A feature [+ Reason] rather than [+ Means] seems appropriate to represent the because-clause in the other example given below (cp. Hornby 1954, 240 f.).

(13)

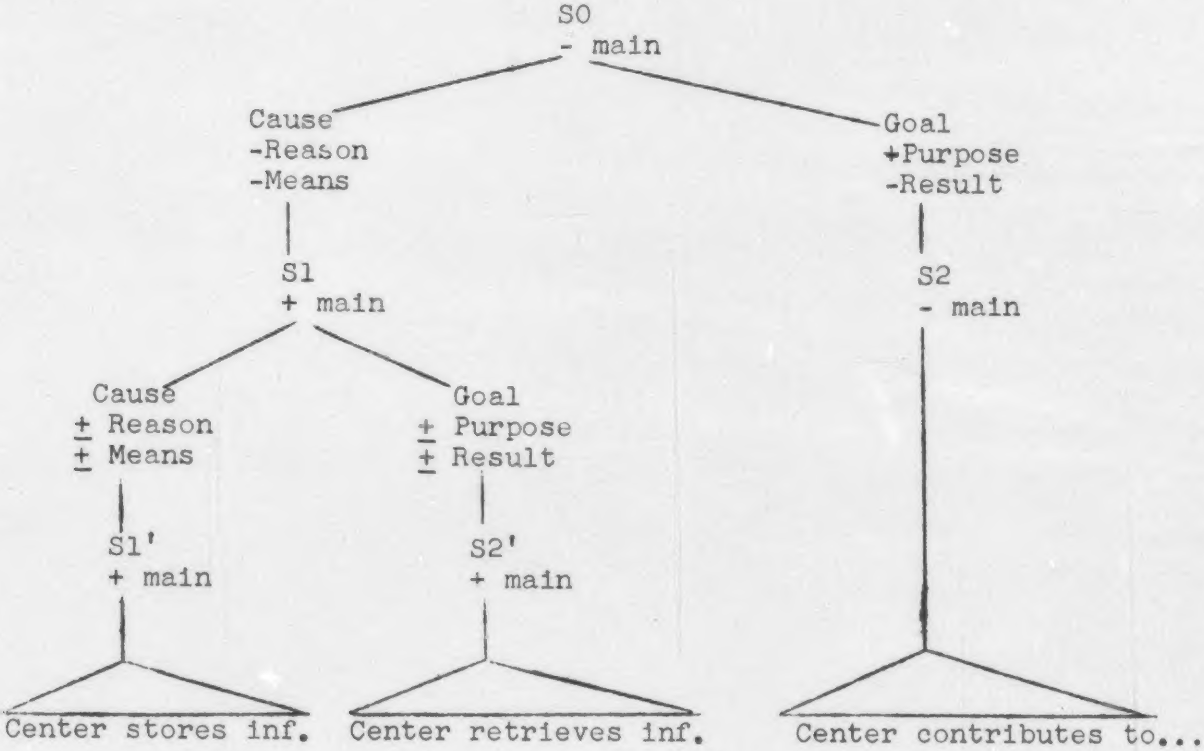

S0
- main
Cause
-Reason
+Means
Goal
-Purpose
-Result
S1
- main
S2
+ main
Cause
± Reason
± Means
Goal
± Purpose
± Result
S1'
+ main
S2'
+ main
Center stores inf.
Center retrieves inf.
Center contributes to...

Example : The Center contributes to the development of science *by* storing and (by)retrieving information.

Cp. : The patient soon recovered *because* the Doctor arrived rapidly and examined her very carefully.

(iv) Purpose expressions corresponding to (iii) would be analyzed as in (14). The expression of purpose is marked *- main* and [+ Purpose]

(14)


S0
- main
Cause
-Reason
-Means
Goal
+Purpose
-Result
S1
+ main
S2
- main
Cause
± Reason
± Means
Goal
± Purpose
± Result
S1'
+ main
S2'
+ main
Center stores inf.
Center retrieves inf.
Center contributes to...

Example : The Center stores and retrieves information *in order to* contribute to the development of science

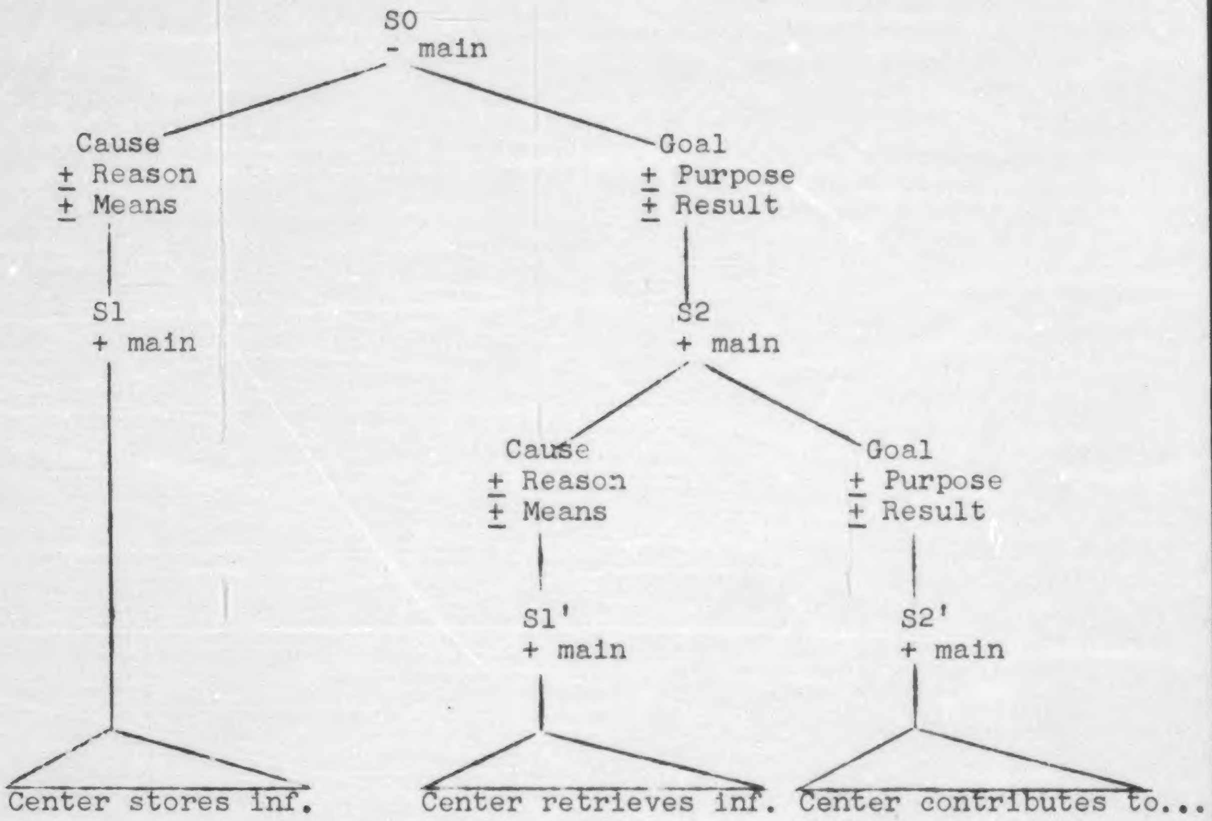
Cp. : The Doctor arrived very quickly and examined the patient very carefully *in order that* she might soon recover.

The main advantage which I would claim for the type of representation I propose has already been mentioned : it captures at the same time the similarities and differences between asymmetrically conjoined sentences and the various constructions relatable to it. Note, in particular, that the recursiveness of the system makes it possible to represent 'mixed' constructions : for instance, the occurrence of a purpose phrase in a by-phrase.

Another advantage is that the concept of Vlast proposed in 3.3.4. can now be more precisely defined. Thus, I suggest that what I have called Vlast can now be defined as the main verb of any sentence which is an exponent of the Goal case.

Note that, under the proposals just made, a given lexical item could have more than one description. For instance, the verb retrieve would have different analyses in (12) above and in the following diagram (15). I regard this consequence as by no means unacceptable, but on the contrary as a desirable one :

(15)


S0
- main
Cause
± Reason
± Means
Goal
± Purpose
± Result
S1
+ main
S2
+ main
Cause
± Reason
± Means
Goal
± Purpose
± Result
S1'
+ main
S2'
+ main
Center stores inf.
Center retrieves inf.
Center contributes to...

Example : The Center stores information, and it retrieves this information and contributes to the development of science.

Cp. : The Doctor arrived rapidly; he examined the patient carefully and she soon recovered.

3.4.2. *Langendoen's projection and relative clauses.*

The only important type of construction relatable to asymmetric conjunction that was left undiscussed in the preceding section is relative clauses, and the various constructions derivable from them : for instance, 'retrieval of the information *which has been processed and stored*' or 'retrieval of the information *stored and processed*' as related to 'process, store and retrieve information'. In what follows, I shall not be concerned with questions of tense : e.g.'*has been*' in the above examples. What I wish to do now is to argue for generating relative clauses on the basis of what Langendoen 1967 calls *projection*, namely the process by which an argument receives specifications corresponding to the predicates with which it has contracted a relation in previous discourse. Moreover, on the basis of the analyses presented in 3.4.1., I shall argue that projection needs to operate irrespective of the type of construction in the previous discourse, that is, no matter whether it is asymmetric conjunction or some other, relatable, construction (cp. J 985 : "procedures used to *store* the punched card information... this *stored* information..."). The whole of the present discussion is based on the methodological principle already mentioned that sentences are to be derived from their most complete representations.

(1) If the semantic representations proposed in 3.4.1. are correct, *sentence conjunction can no longer be regarded as the ONLY source of relative clauses*. In other words, relative clause formation would be just a matter of projection and would not be sensitive to a surface structure (such as conjunction), but only to deep structures (such as those just proposed). The frequent occurrence of deictics in NP's relatable to relative clauses (see 16) is a strong argument for the central place I propose for projection in relative clause formation.

Compare (16) (a), (b), (c), and (d) :

(16)

(a) The Center *stores* information AND retrieves the *stored* information.
(b) The *storage* of the information RESULTS in the retrieval of *this stored* information.
(c) The Center *stores* information IN ORDER TO retrieve this *stored* information.
(d) BY *storing* information, the Center (is able to) retrieve *this stored* information.

(ii) (16) (b) is a case in which the deletion of the source sentence is most obviously RULED OUT : *x Ø results in the retrieval of the stored information*.

(iii) An example such as (16) (d) suggests that relative clause formation must be sensitive to the *left-to-right order of constituents in surface structure*. Devices such as global derivational constraints therefore seem to be necessary for generating relative clauses. This type of rule, the formal mechanism of which has been described by Lakoff 1969a, is the only one known to me that is able to specify, for instance, that a relative clause is only possible if the 'source sentence' *precedes* the NP into which the relative clause can be embedded in the resulting *surface* structure. Compare (17) (a) and (b) :

(17)

(a) By *storing* information, the Center is able to retrieve this *stored* information.
(b) x The Center is able to retrieve this *stored* information by *storing* it.

(iv) I now wish to turn to some more abstract surface expressions than those so far discussed. Such expressions obviously need to be related to relative clauses. I believe that a distinction needs to be made between two superficially similar constructions. One type is exemplified below in (18), the other in (19).

(18)

(a) ... a regular scrutiny of over one thousand current periodicals with consequent indexing and distribution of the resulting information (J 466).
(b) ... how to conduct bibliographical investigation and how to present the resulting data (J 142).

(19)

(a) the increasing volume of literature, the rapid fragmentation of biology and its resultant increase in semantic problems (J 931).
(b) Although subjects exhibited some reliability in selecting representative sentences, the resultant reliability was low (J 816).

I believe the difference between the examples of (18) and (19) to be the following. "The resulting information" in (18) (b) is equivalent to 'the information that resulted from the events or actions previously mentioned': for instance, "indexing and distribution of the resulting information" is equivalent to 'indexing and distribution of the indexed information'. I regard this as an instance of projection. I suggest that the other type is to be analyzed along the lines proposed in the preceding section : compare, for instance, 'The Doctor's speedy arrival and careful examination of the patient and the resultant improvement in her condition'. This 'resultant' could be generated optionally, given the presence of a feature [+ Result] attached to the Goal clause.

Also note that in any case it cannot be 'derived' from a previous conjunct in the fashion proposed by Annear and Langendoen.

(v) In this discussion of relative clause formation and projection, I have to mention a further complication. I have found no attested example of the constructions I wish to present in this paragraph, but I believe they are possible. What they suggest is that the various constructions relatable to asymmetric conjunction that were encountered in main clauses are also possible in relative clauses. Consider the following sentences :

(20)

(a) The Center will contribute to the development of science by collecting information, by processing the collected information, by storing the information which has been collected AND processed, and by retrieving the information which has been collected, processed, AND stored.

(b) The Center will contribute to the development of science by collecting information, by processing the collected information, by storing the information which has been collected FOR processing, and by retrieving the information which has been collected and processed FOR storing.

(c) ? The Center will contribute to the development of science by collecting information, by processing the collected information, by storing the information which can be processed BY being collected, and by retrieving this information which can be stored BY being collected and processed.

(d) The Center will contribute to the development of science by collecting information, by processing the collected information, by storing the information whose collecting RESULTS in its being processed, and by retrieving this information whose collecting and processing RESULTS in its being stored.

I regard the possibility of there being sentences such as those just given as further evidence upholding the semantic representations proposed in 3.4.1. as well as the suggestions I have advanced for deriving relative clauses on the basis of Langendoen's projection rather than according to the Annear-Langendoen hypothesis.

(vi) Conjunction reduction should operate after the generation of deictic noun-phrases, and these, in turn, should be generated after the operation of Langendoen's projection. On the basis of what has been said in 3.3.2. we can assume that the order of generation illustrated below in (21) is the one that needs to be adopted (I ignore the problem of the first noun-phrase "mechanized information retrieval systems") :

(21)

(a) Most mechanized information retrieval systems depend upon extracting information from documents, processing the *extracted* information in some manner and finally placing the *extracted and processed* informatinn in a file so that the information *which has been extracted, processed, and filed* can be retrieved by machine.

(b) Most mechanized information retrieval systems depend upon extracting information from documents, processing *such* information in some manner and finally placing *this* information in a file so that *the information* can be retrieved by machine. (J 321).

(c) Most mechanized information retrieval systems depend upon extracting, processing and filing *information* so that *it* can be retrieved by machine.

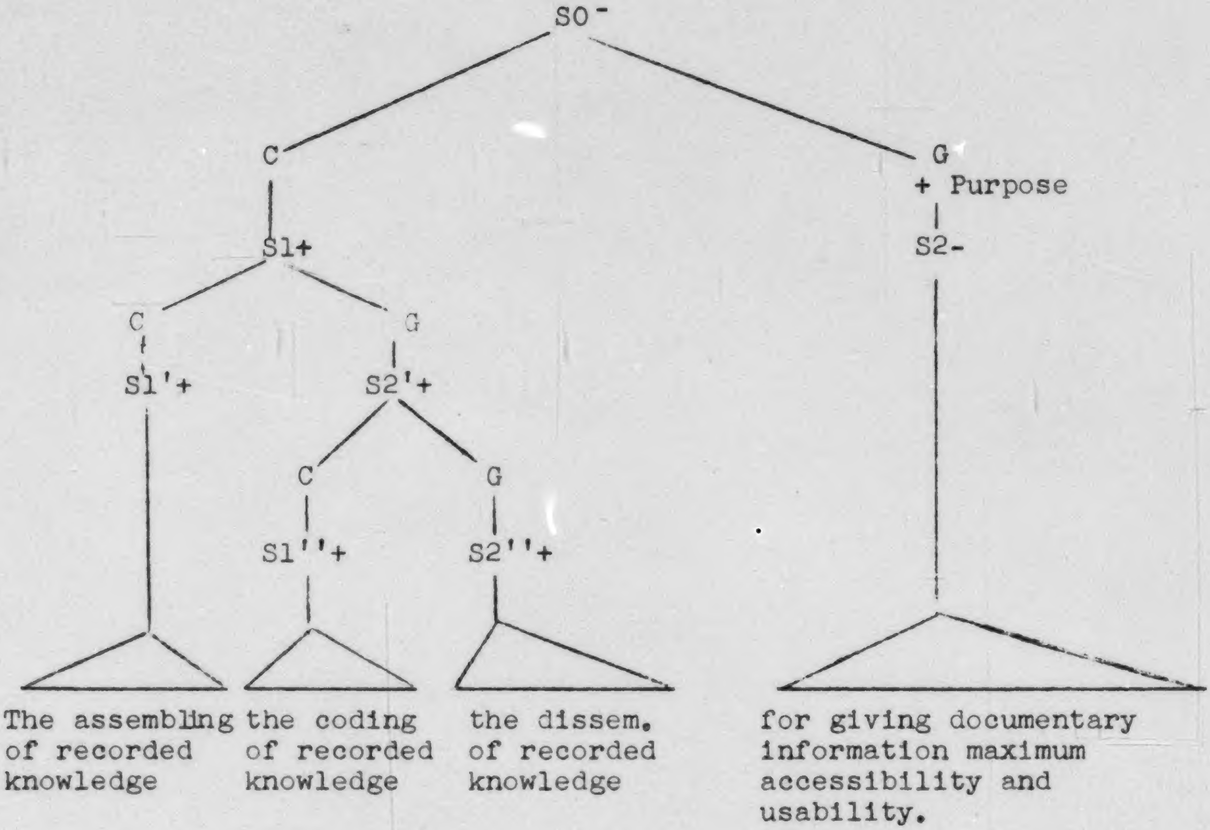
(vii) Further evidence for regarding projection rules that create relative clauses as very early rules is that projection may be needed to explain the occurrence of certain lexical items, as has been argued in 3.3.2. Consider, for instance the expression "*on deposit*" in : "*a full account of his research* (...) which *is permanently filed in a central repository* (...) the full papers *on deposit*" (J 783).

While I am unable to write rules that would generate relative clauses on the basis of projection, I would suggest, to conclude, that the possibility which projection affords for earlier discourse to be 'mirrored in relative clauses of later discourse is one of the ways in which asymmetrically conjoined sentences can satisfy the identity requirements which Z. Harris and R. Lakoff posit for conjoined structures.

3.4.3. A few attested examples.

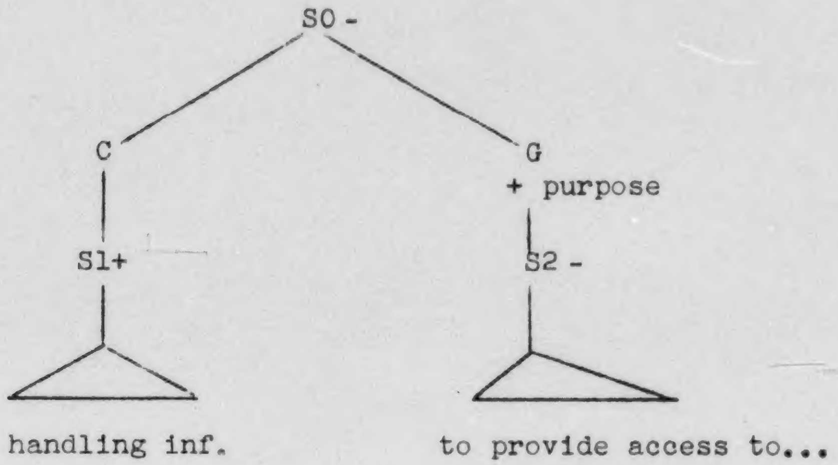
The examples analyzed in this section consist of definitions of documentation, or equivalent expressions. By equivalent expression, I mean any material which is equivalent to the word 'documentation' in its global sense: for instance, 'a center which collects,processes, stores, and retrieves information' is equivalent to 'a documentation center'. The analyses will be presented graphically in the form of tree diagrams such as those presented in 3.4.1. Under each tree, I give the full quotation of the passage analyzed. When some material is left unanalyzed in a tree, it is given between brackets in the full quotation. This means either that I am unable to analyze the material in question or that it falls outside the scope of the present discussion. In the trees given below, C stands for Cause, and G for Goal, and + for + main and - for - main. Some of the analyses presented below are no doubt questionable, irrespective of the general validity of my proposals; the trouble, however, is that there seem to be no clues either to refute an analysis or to establish an alternative analysis. This is most obviously the case with some conjunctions : see in particular (30) - (32). The only criterion I have found is the existence of abbreviated expressions, which I propose to analyze as Goal : "(storage and) retrieval", "(...and) dissemination", etc. Various words such as prepositions which can serve as evidence for my analyses are capitalized in the quotations. Except for -(main), I shall omit all - and + feature specifications, in order to simplify the presentation.

(22)


S0-
C
G
+ Purpose
S1+
S2-
C
G
S1'+
S2'+
C
G
S1''+
S2''+
The assembling of recorded knowledge
the coding of recorded knowledge
the dissem. of recorded knowledge
for giving documentary information maximum accessibility and usability.

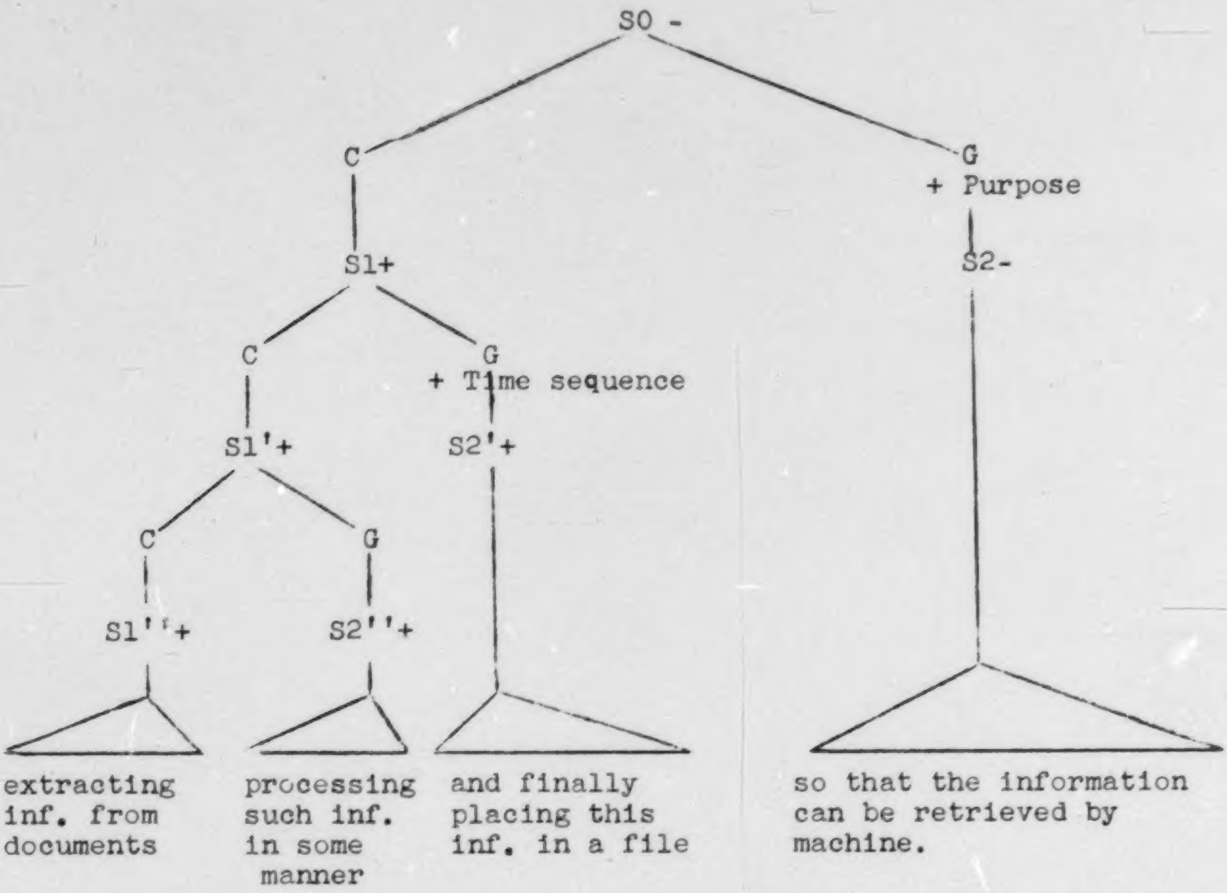
Example : The assembling, coding and dissemination of recorded knowledge (comprehensively treated as an integral procedure utilizing semantics, psychological and mechanical aids and techniques of reproduction including microcopy) FOR giving documentary information maximum accessibility and usability. (Webster's definition of documentation).

(23)


SO -
C
G
+ purpose
S1+
S2 -
handling inf.
to provide access to...

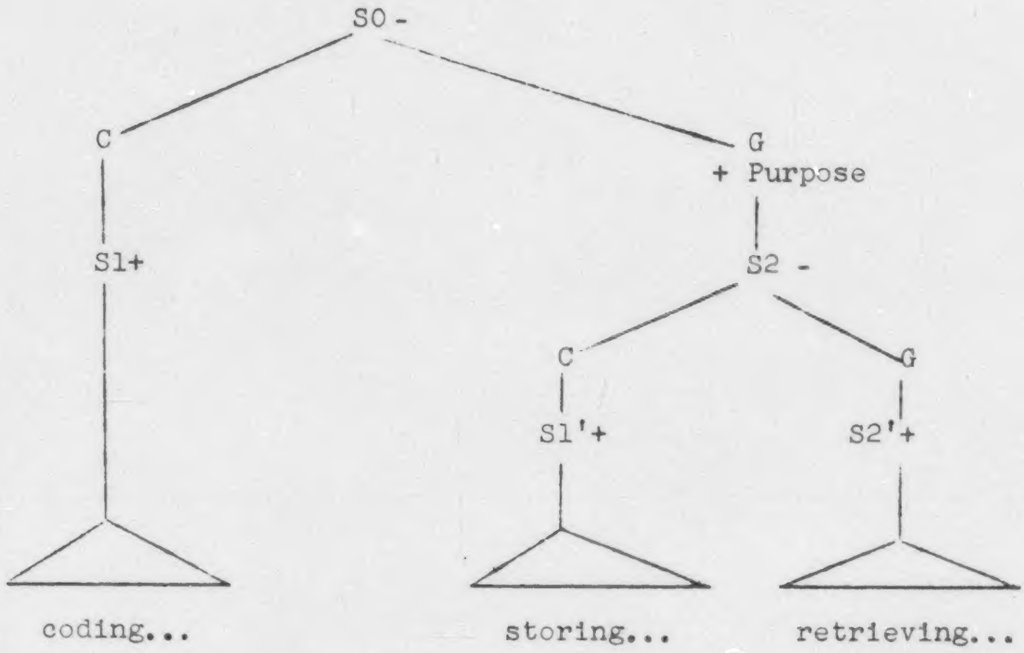
Example : ... handling scientific information TO provide access to the scientific literature (J 263).

(24)


S0 -
C
G
+ Purpose
S1+
S2-
C
G
+ Time sequence
S1'+
S2'+
C
G
S1''+
S2''+
extracting inf. from documents
processing such inf. in some manner
and finally placing this inf. in a file
so that the information can be retrieved by machine.

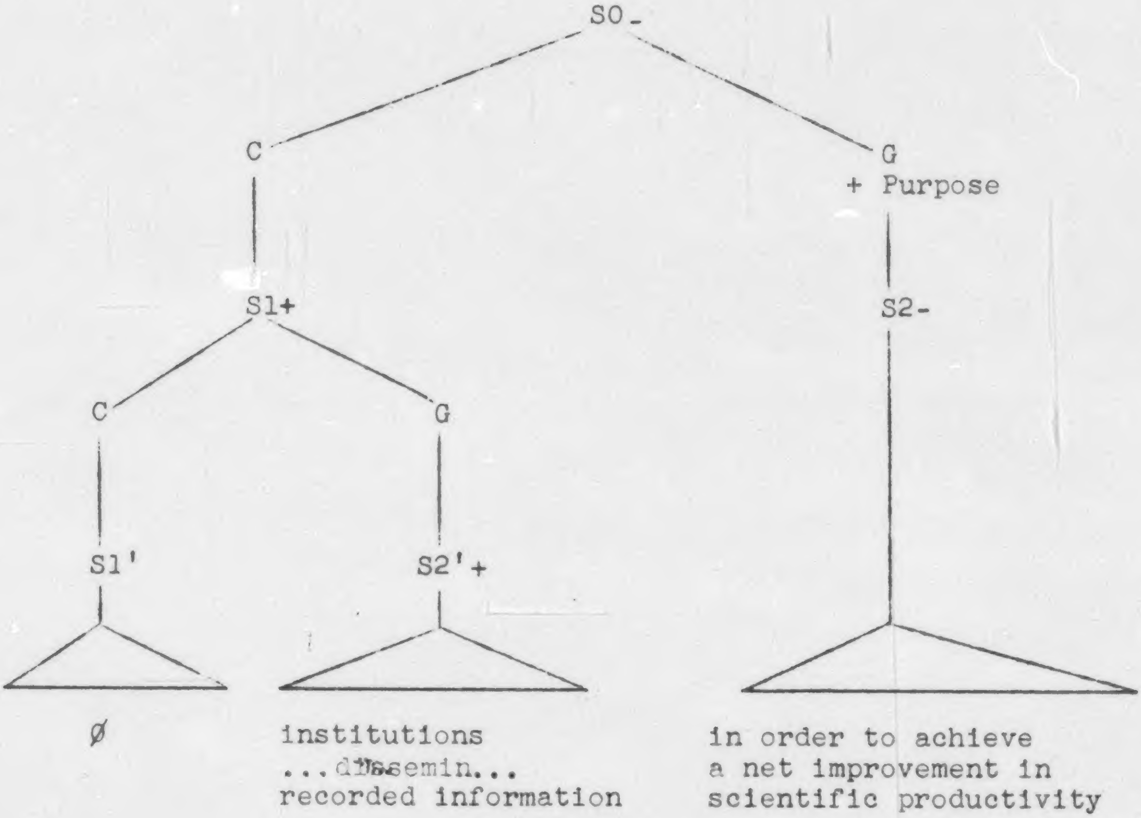
Example : (Most mechanized information retrieval systems depend upon) extracting information from documents, processing such information in some manner, AND FINALLY placing this information in a file SO THAT the information can be retrieveu by machine (J 321).

(25)


S0 -
C
G
+ Purpose
S1+
S2 -
C
G
S1'+
S2'+
coding...
storing...
retrieving...

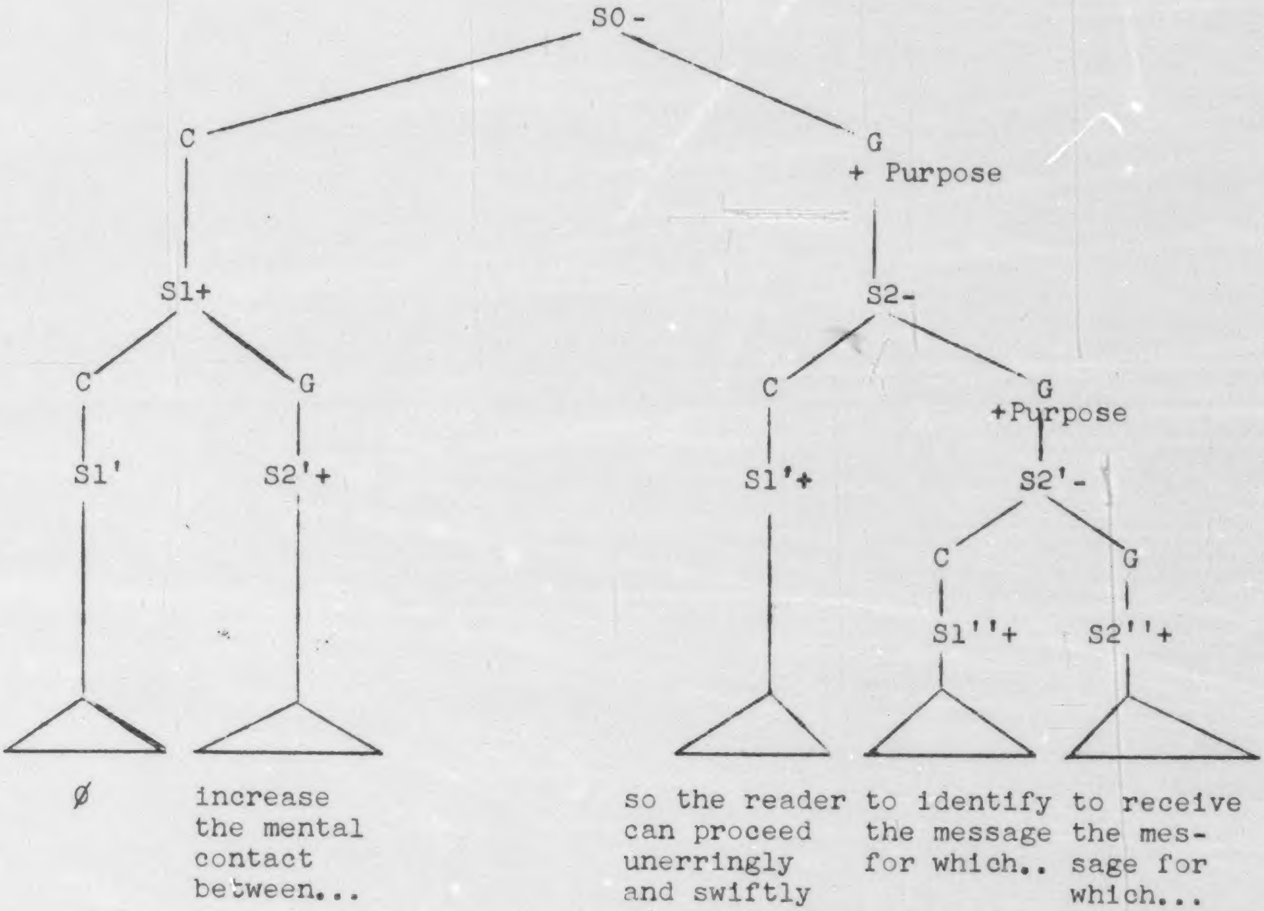
Example : (Introduces a method of) coding two and three dimensional representations (...) FOR THE PURPOSE OF storing and retrieving them. (J330)

(26)


S0-
C
G
+ Purpose
S1+
S2-
C
G
S1'
S2'+
Ø
institutions
...dissemin...
recorded information
in order to achieve
a net improvement in
scientific productivity

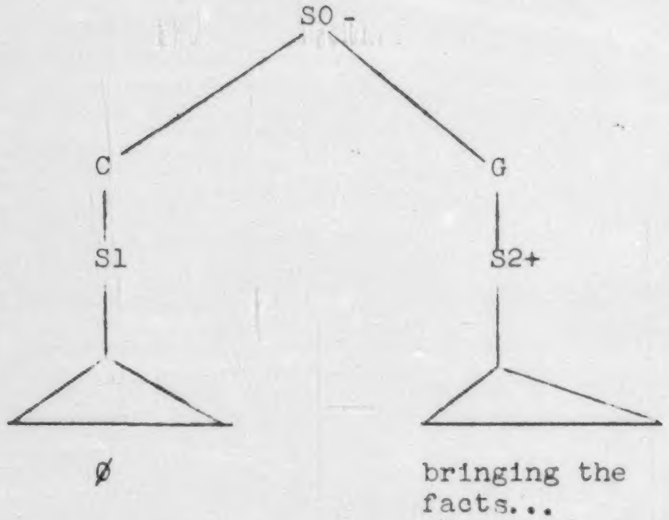
Example : (institutions that are responsible for) the dissemination of recorded information IN ORDER TO achieve a net improvement in scientific productivity (J2).

(27)


S0-
C
G
+ Purpose
S1+
S2-
C
G
C
G
+Purpose
S1'
S2'+
S1'+
S2'-
C
G
S1''+
S2''+
Ø
increase the mental contact between...
so the reader can proceed unerringly and swiftly
to identify the message for which..
to receive the message for which...

Example : (The basic problem is to) increase the mental contact between the reader and the information stored SO the reader can proceed unerringly and swiftly TO identify and receive the message for which he is looking (J257).

(28)



Example : (Scientific documentation -- the operation of) bringing the facts elucidated by scientific research from those who produce them to those who can make use of them (is getting out of hand) (J 97).

Cp. : (states the problem of) bridging the gap between the individual who wants the information and the records containing the information (J 205).

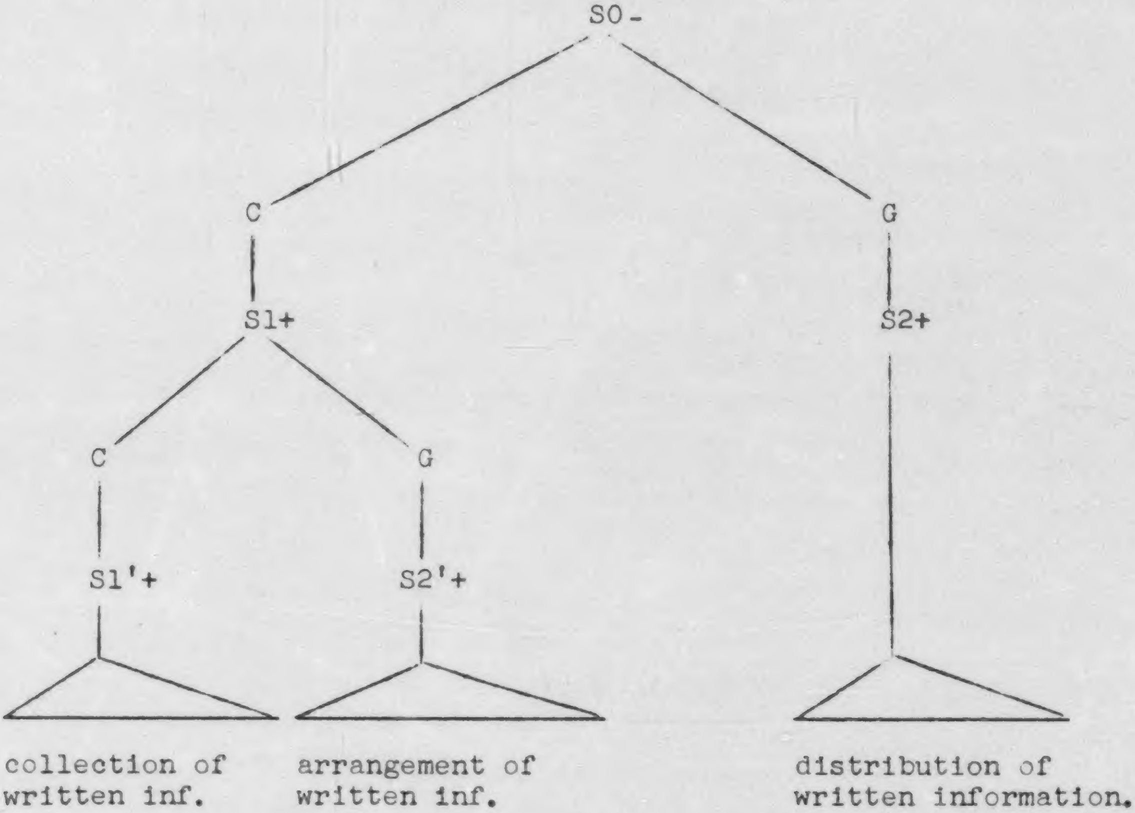
Cp. : (it's the intellectual job of) matching what's known and what's wanted (J 407.

Cp. : Finding what's known (J 407).

Cp. : (Discusses the problem of) getting information into the hands of the scientist who needs it (even when he doesn't know about it) (J 418).

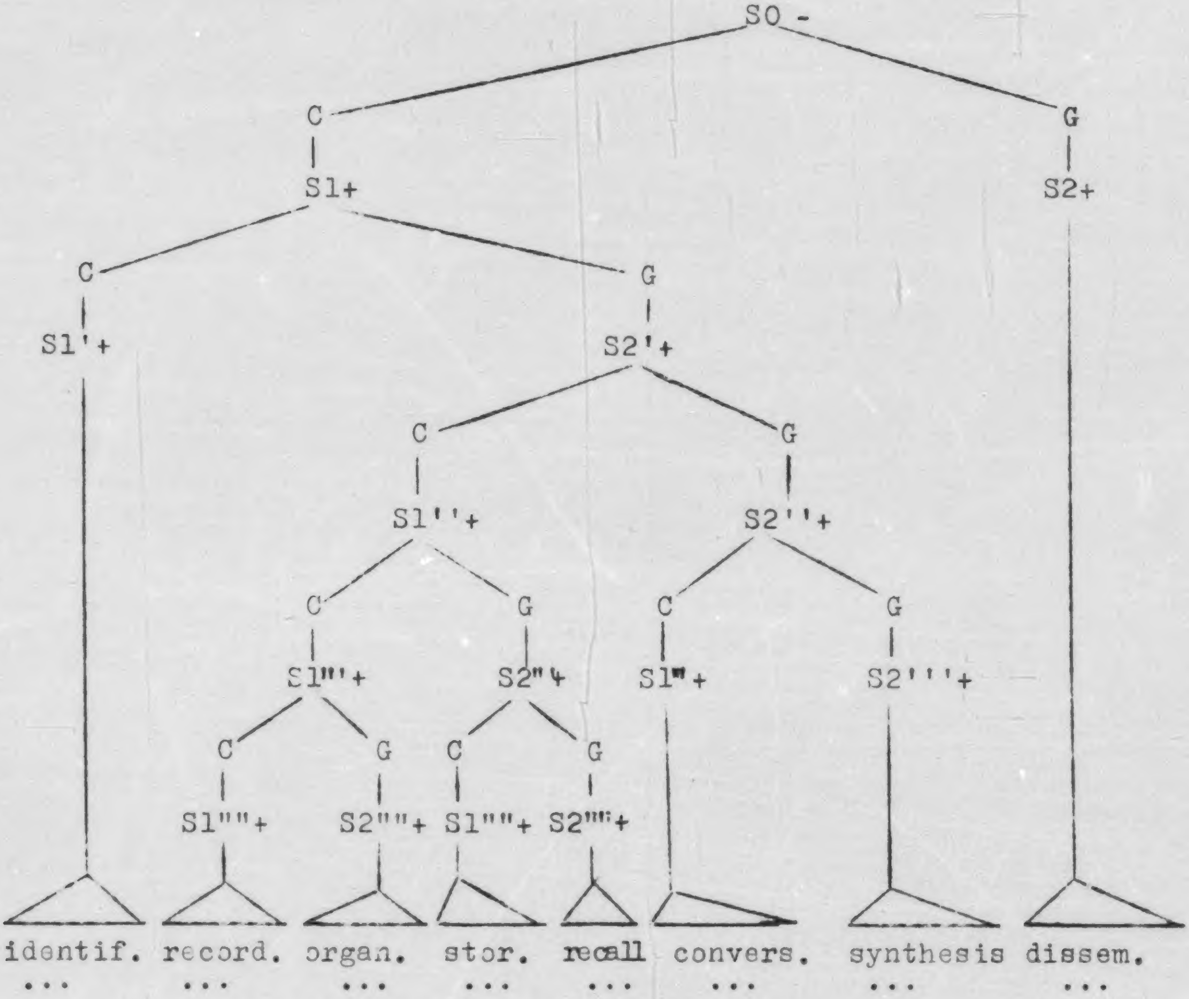
Cp. : the man-document communication (problem)(J 1110).

(29)


SO-
C
G
S1+
S2+
C
G
S1'+
S2'+
collection of written inf.
arrangement of written inf.
distribution of written information.

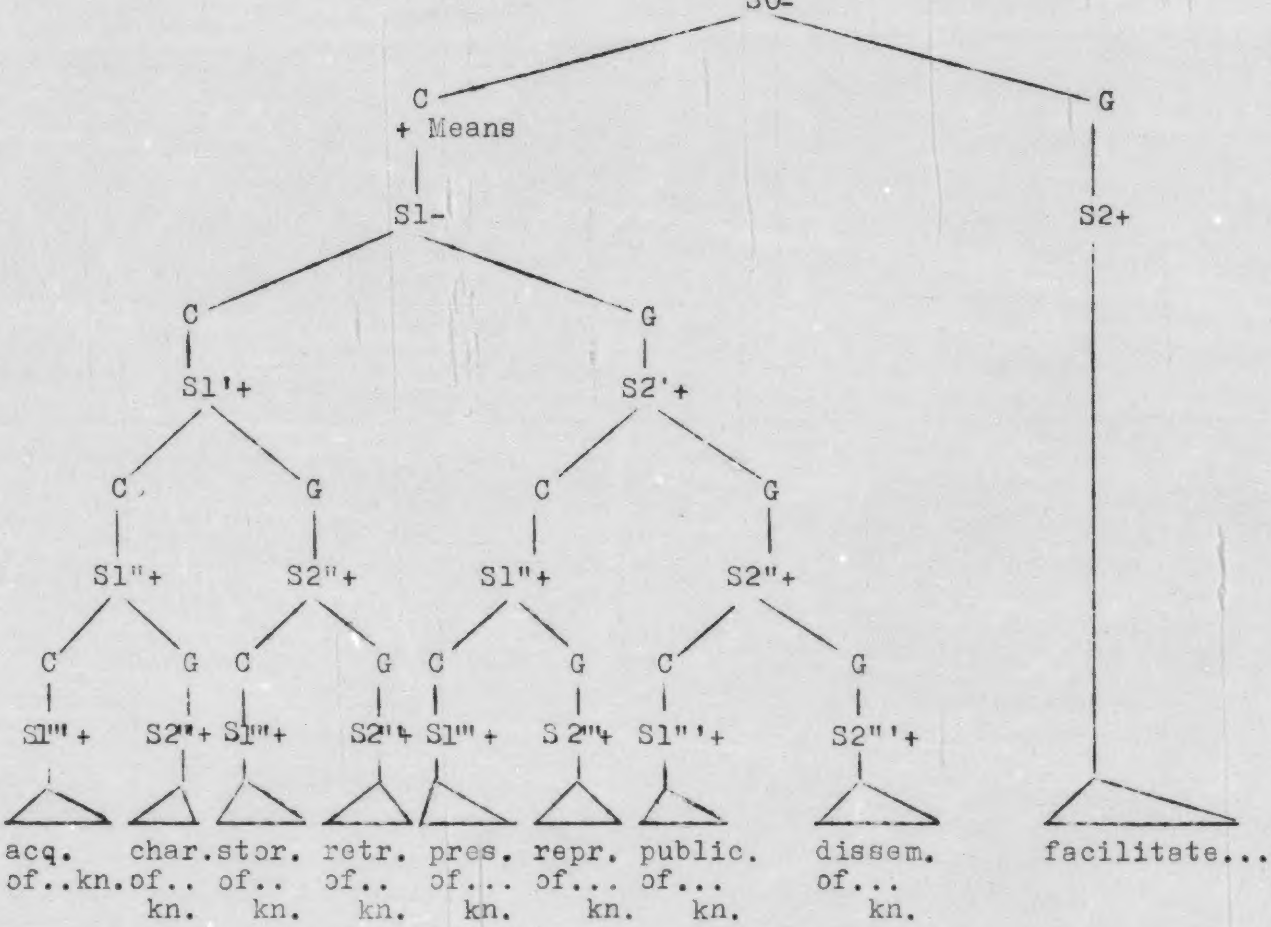
Example : (Documentation should not be cnntrasted with library work it is a phase or aspect in the chain of) collection, arrangement, AND distribution of written information (as found in libraries)(J 474).

(30)


S0 -
C
G
S1+
S2+
C
G
S1'+
S2'+
C
G
S1''+
S2''+
C
G
C
G
S1'''+
S2'''+
S1'''+
S2'''+
C
G
C
G
S1""+
S2""+
S1""+
S2""+
identif. ...
record. ...
organ. ...
stor. ...
recall ...
convers. ...
synthesis ...
dissem. ...

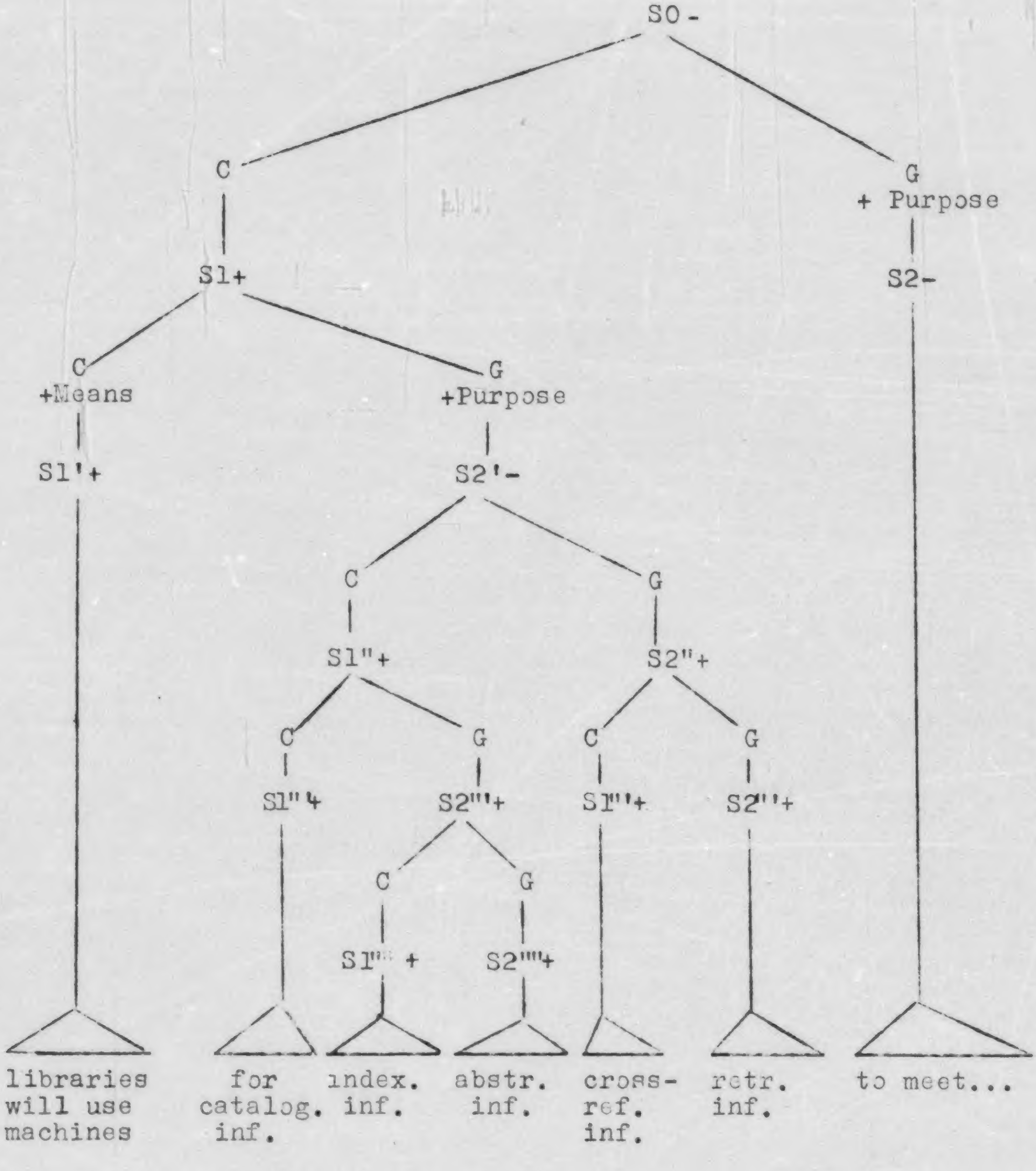
Example : ("Documentation is best differentiated from normal library service by the extent to which it is concerned with a complete-cycle service providing information. This cycle involves) the identification, recording, organization, storage, recall, conversion into more useful form, synthesis, and dissemination of the intellectual content of print and other recorded materials." (J 890).

(31)


S0-
C
+ Means
G
S1-
S2+
C
G
S1'+
S2'+
C
G
C
G
S1"+
S2"+
S1"+
S2"+
C
G
C
G
C
G
C
G
S1"'+
S2"'+
S1"'+
S2"'+
S1"'+
S2"'+
S1"'+
S2"'+
acq. of..kn.
char. of.. kn.
stor. of.. kn.
retr. of.. kn.
pres. of... kn.
repr. of... kn.
public. of... kn.
dissem. of... kn.
facilitate...

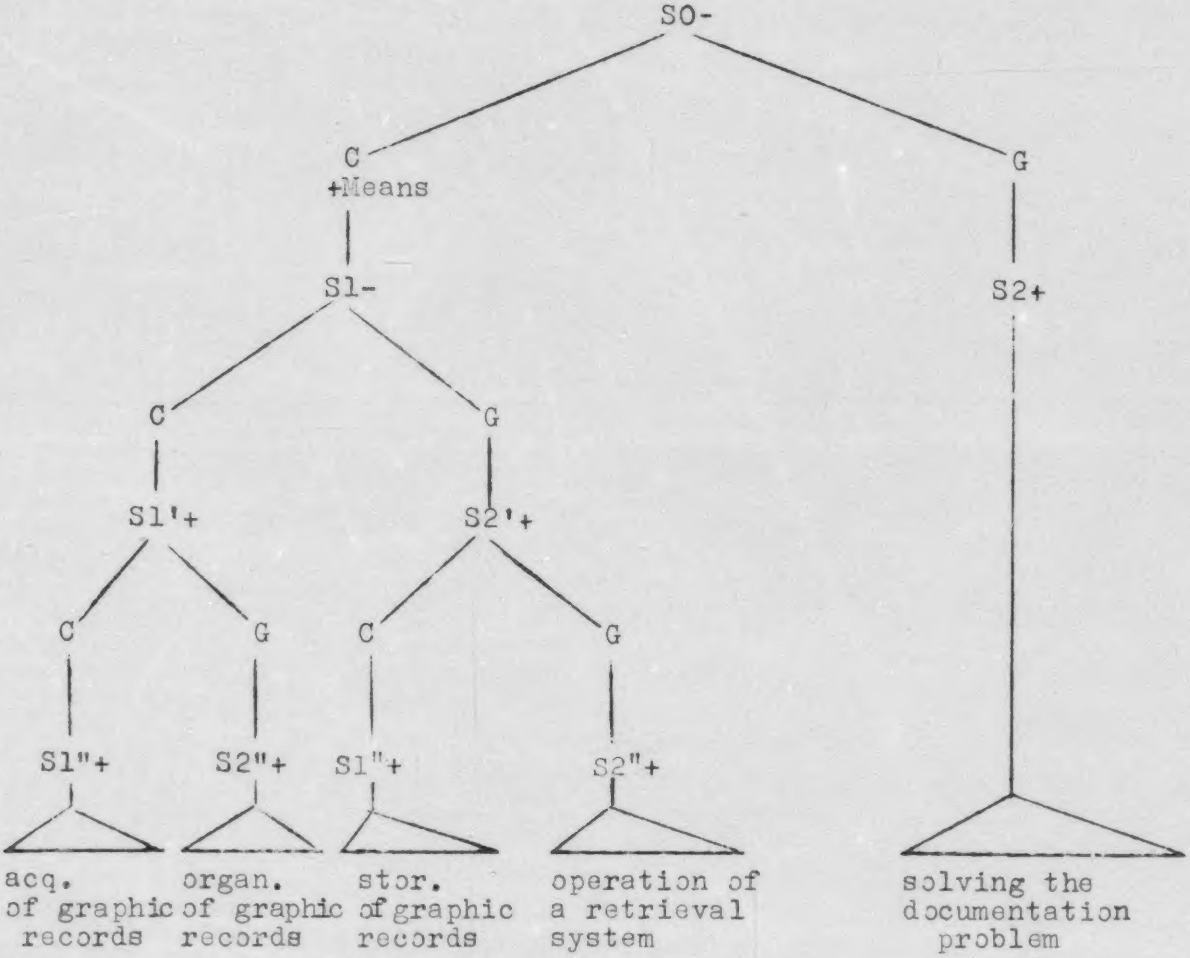
Example : (A documentation system is defined as a complex pattern of interacting and interdependent processes which) facilicates the use of recorded specialized knowledge THROUGH its presentation, reproduction, publication, dissemination, acquisition, characterization, storage and retrieval (J 107).

(32)


S0 -
C
G
+ Purpose
S1+
S2-
C
+Means
G
+Purpose
S1'+
S2'-
C
G
S1"+
S2"+
C
G
C
G
S1"'+
S2"'+
S1"'+
S2"'+
C
G
S1"" +
S2""+
libraries will use machines
for catalog. inf.
index. inf.
abstr. inf.
cross-ref. inf.
retr. inf.
to meet...

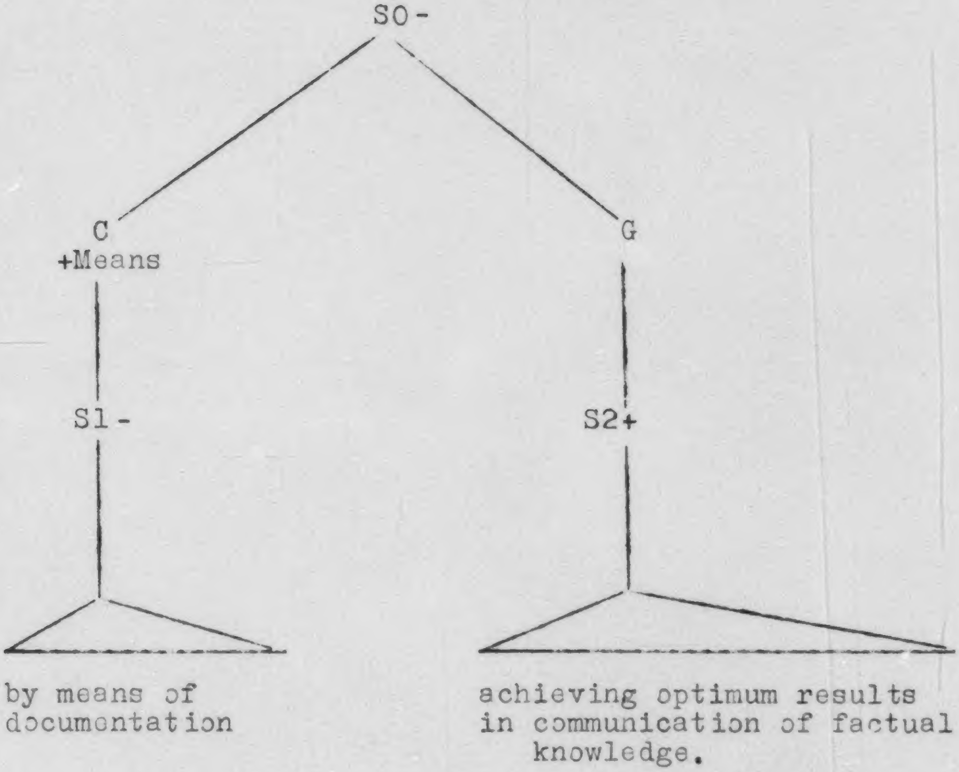
Example : TO meet the increasing value of scientific and technical information, the libraries will use machines FOR cataloguing, indexing, abstracting, cross-referencing, and retrieving of information (J 363).

(33)


SO-
C
+Means
G
S1-
S2+
C
G
S1'+
S2'+
C
G
C
G
S1"+
S2"+
S1"+
S2"+
acq. of graphic records
organ. of graphic records
stor. of graphic records
operation of a retrieval system
solving the documentation problem

Example : (The documentation problem and means of)solving it THROUGH acquisition, organization and storage of graphic records, and the operation of a retrieval system (are reviewed...) (J 497).

(34)


SO-
C
+Means
G
S1-
S2+
by means of documentation
achieving optimum results in communication of factual knowledge.

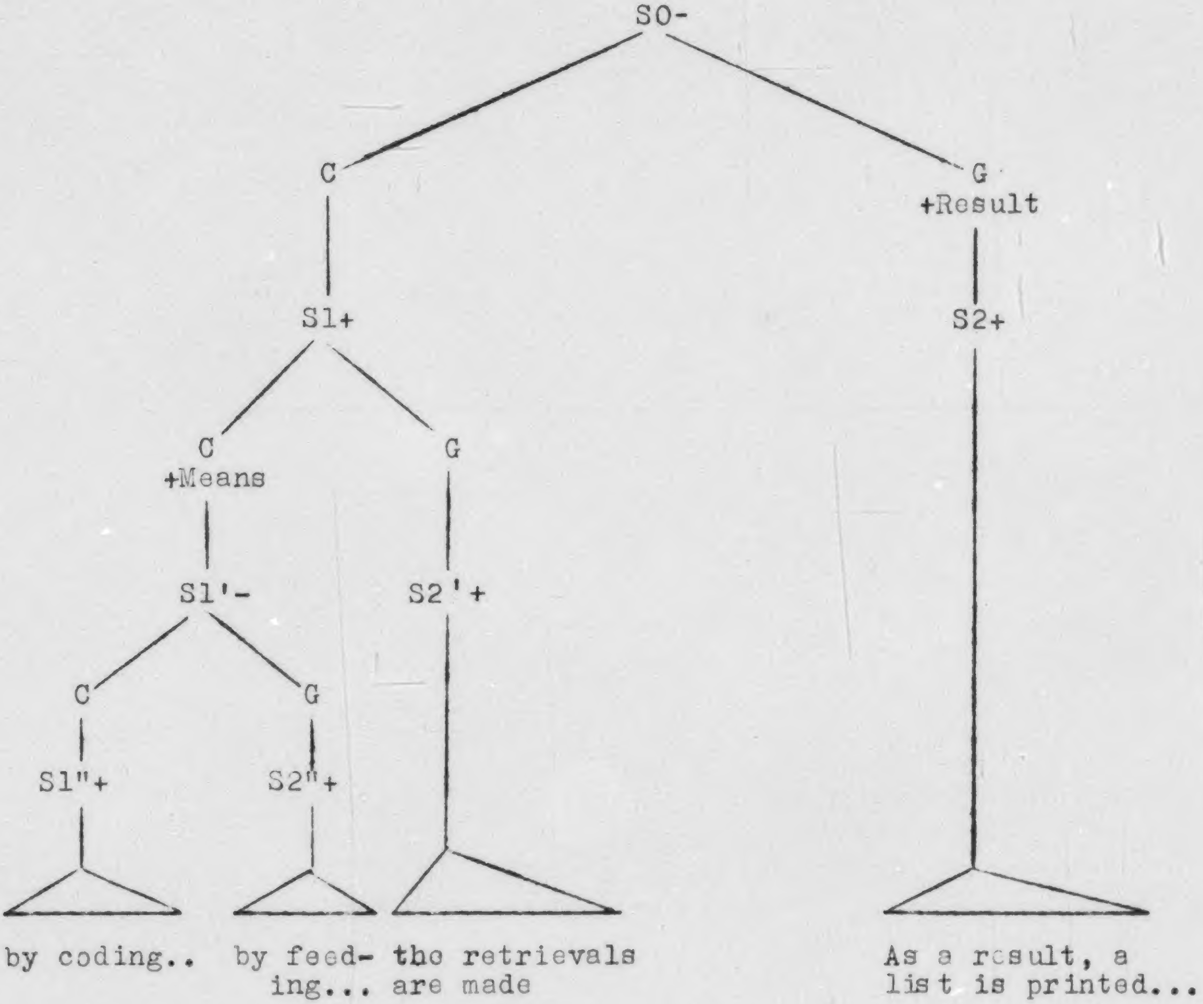
Example : (Discusses methods and techniques of) achieving optimum results in communication of factual knowledge BY MEANS OF documentation (J 772).

As a further example, I wish to quote the following abstract in order to suggest that the type of analysis I propose could be extended to discourse structures; note, in particular, the phrase as a result in the last sentence. I shall refrain from presenting a complete analysis of the text, however, because I do not fully understand it. I shall just present an analysis of the last two sentences in (36).

(35)

> A system is described which permits handling of abstracts in a largely mechanical way for documentation and information. The abstracts are made by using a subject index and are then recorded on magnetic tape. These subjects are coded automatically in the machine and transferred to a special "index tape" or the "index part" of the "text-in-clear-tape". The retrievals are made by coding the subjects of the question and feeding them into the machine. As a result, a list is printed containing the abstracts in question as text-in-clear (J69).

(36)

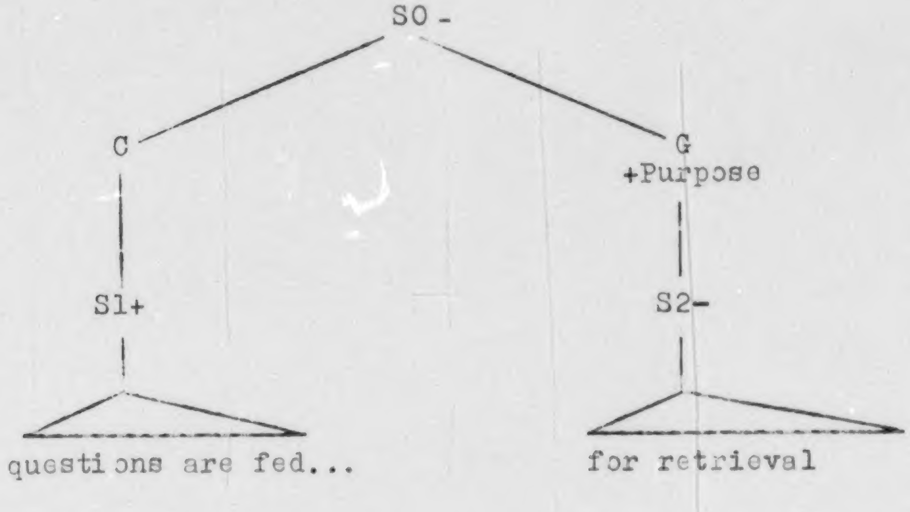

S0-
C
G
+Result
S1+
S2+
C
+Means
G
S1'-
S2'+
C
G
S1"+
S2"+
by coding..
by feed-
ing...
the retrievals
are made
As a result, a
list is printed...

Example : The retrievals are made by coding the subjects of the question and feeding them into the machine. As a result, a list is printed containing the abstracts in question as text-in-clear (J 69).

3.4.4. A few attested examples.

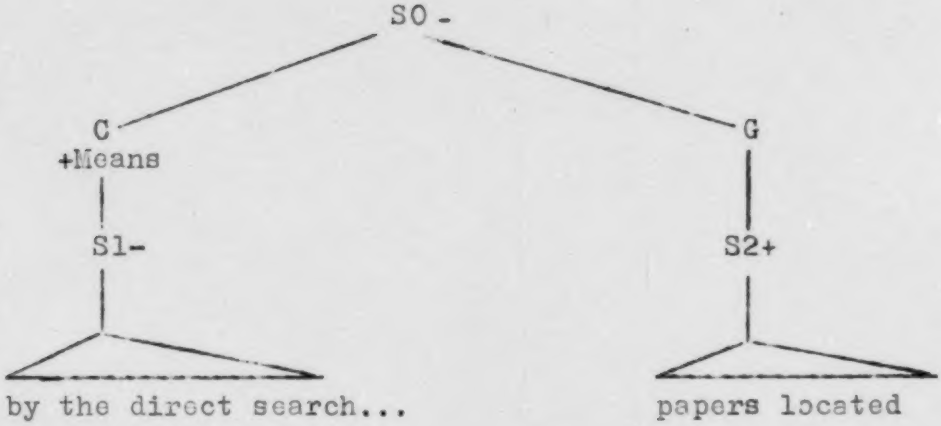
The second set of analyses will also be presented in the form of diagrams. What I wish to stress here is the great variety of surface forms which can serve to express what I analyze as a Cause/Goal relation. A few features not mentioned so far will be used in the ensuing analyses. In some sentences, it is difficult to decide what (if anything) is to be the verb of the main sentence (SO). This is particularly true of modals. Thus, according to Langendoen 1970 (186-191) and many others, auxiliaries and tense markers are to be analyzed as predicates and the remaining material as their argument(s). One of the semantic arguments for such an analysis is that auxiliaries (say, 'must') can be used in the same meaning as predicates (e.g. 'necessary', or 'certain' for 'must'). I feel, however, that an alternative analysis is possible in some cases, and that it is difficult to find reasons for rejecting it. Compare, for instance (45) with (46), (52) with (53), and (68) with (69).

(37)



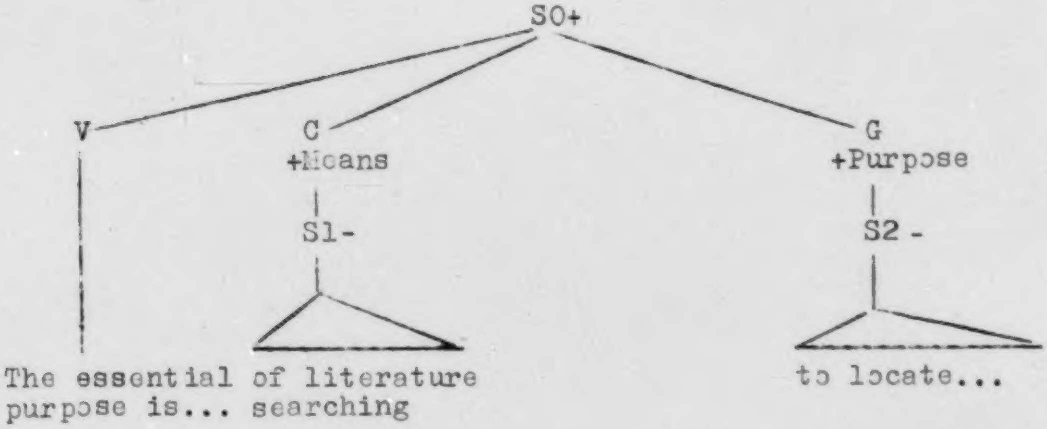
Example : FOR retrieval, questions are fed through a standard switch board... (J 808).

(38)


SO -
C
+Means
S1-
G
S2+
by the direct search...
papers located

Example : papers located BY the direct search of the abstracting journal (J 156).

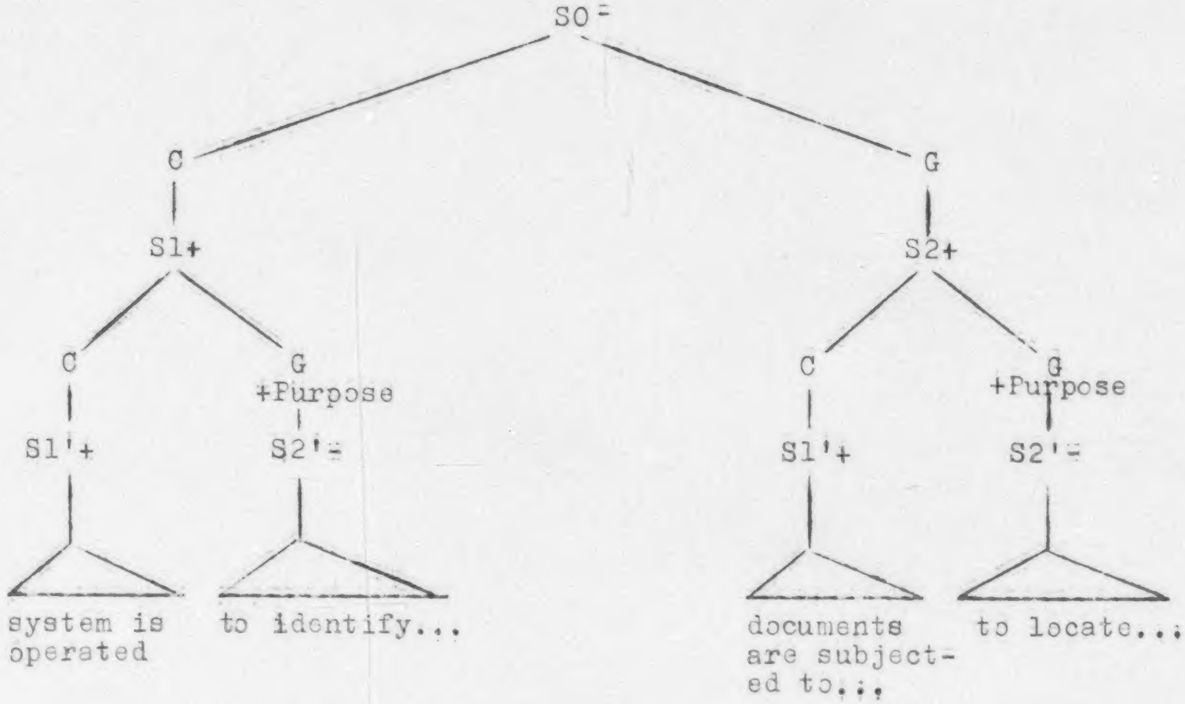
(39)


SO+
V
C
+Means
S1-
G
+Purpose
S2 -
The essential purpose is...
of literature searching
to locate...

Example : The essential purpose of literature searching is to locate... (J 773).

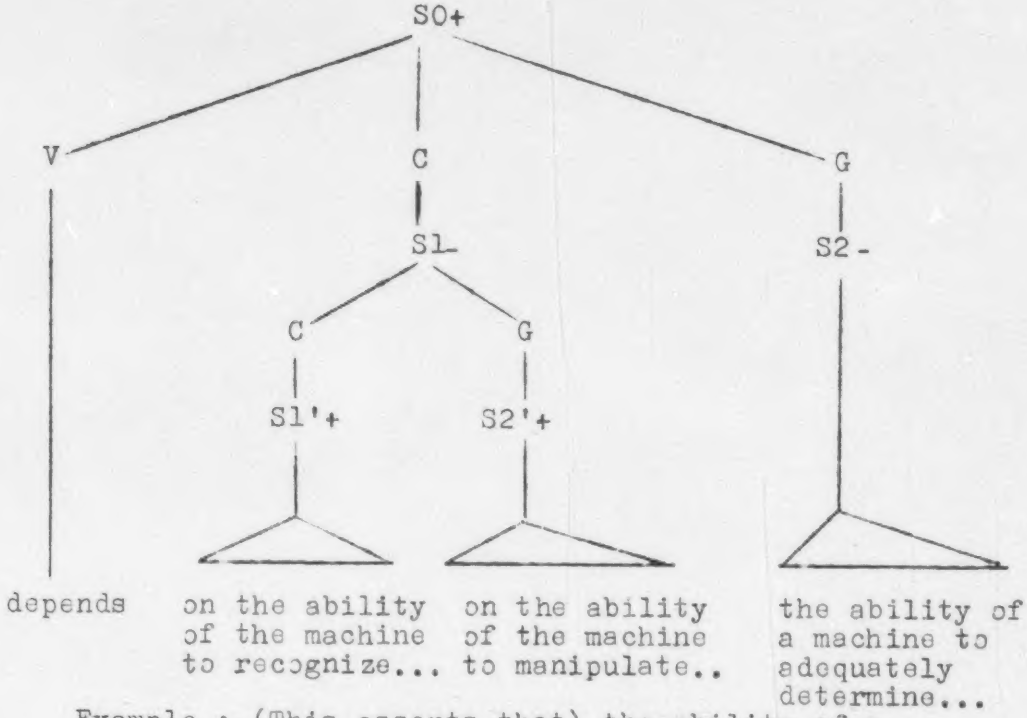
Cp. :
- The objective of scientific communication is to inform (J 247).
- The objective of the indexer is to provide... (J 565). (= of the indexer's activity ?).
- The main purpose of this paper is to study... (J 990). (= of writing this paper ?).
- The purpose of the procedures is to encourage... (J 995) (= of using the procedures ?).
- To V is the purpose of V.

(40)


S0=
C
G
S1+
S2+
C
G
+Purpose
S1'+
S2'=
C
G
+Purpose
S1'+
S2'=
system is operated
to identify...
documents are subjected to...
to locate...

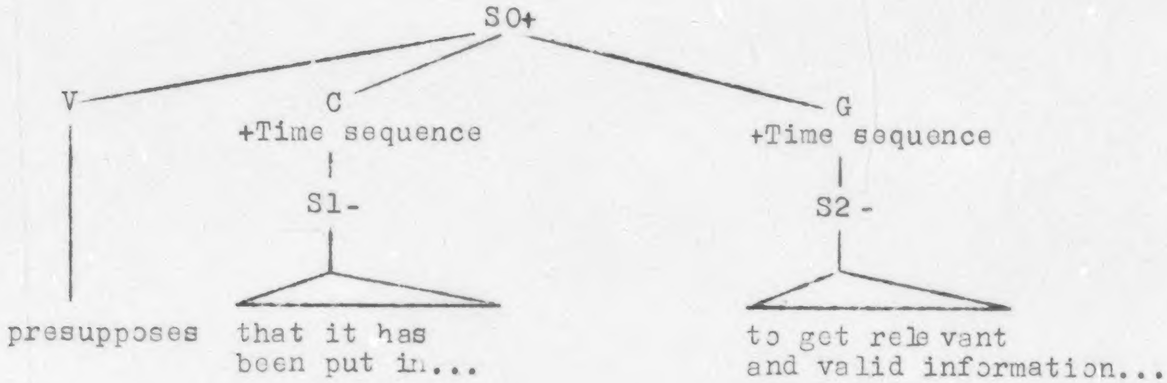
Example : the selection system is operated TO identify those documents of probable pertinent interest; and the documents so selected are subjected to personal review TO locate the desired information (J 773).

(41)


S0+
V
C
G
S1-
S2-
C
G
S1'+
S2'+
depends
on the ability of the machine to recognize...
on the ability of the machine to manipulate..
the ability of a machine to adequately determine...

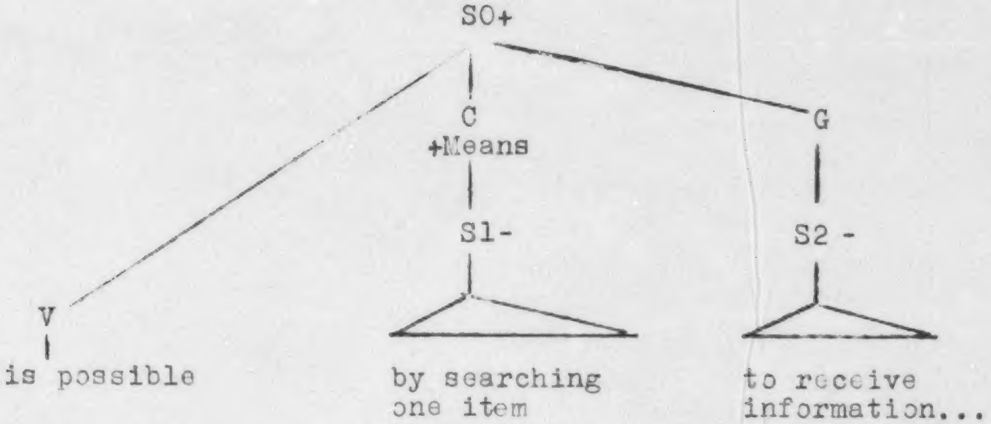
Example : (This asserts that) the ability of a machine to adequately determine information relevance depends strongly on its ability to recognize and manipulate the syntactic structures of the text (J 176).

(42)


S0+
V
C
+Time sequence
G
+Time sequence
S1-
S2-
presupposes
that it has been put in...
to get relevant and valid information...

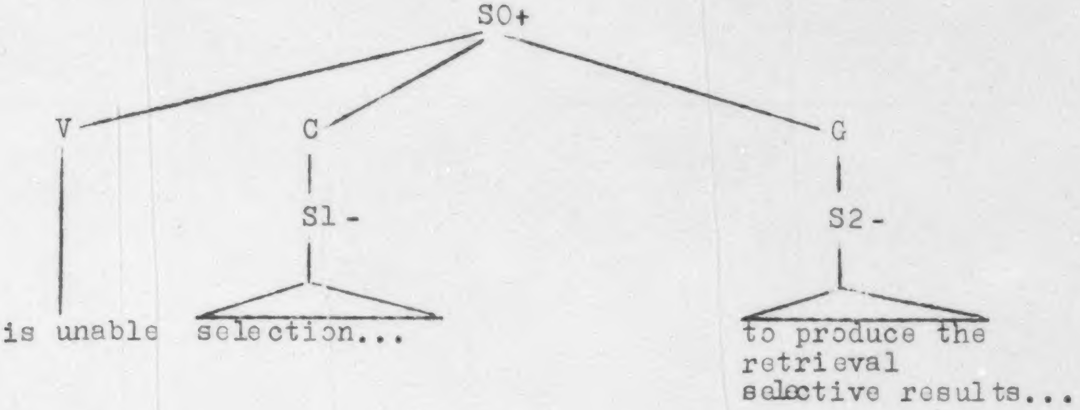
Example : To get relevant and valid information out of a machine presupposes that it HAS BEEN put in with a most exacting pattern of forethought (J 179).

(43)


SO+
C
+Means
G
S1-
S2 -
V
is possible
by searching one item
to receive information...

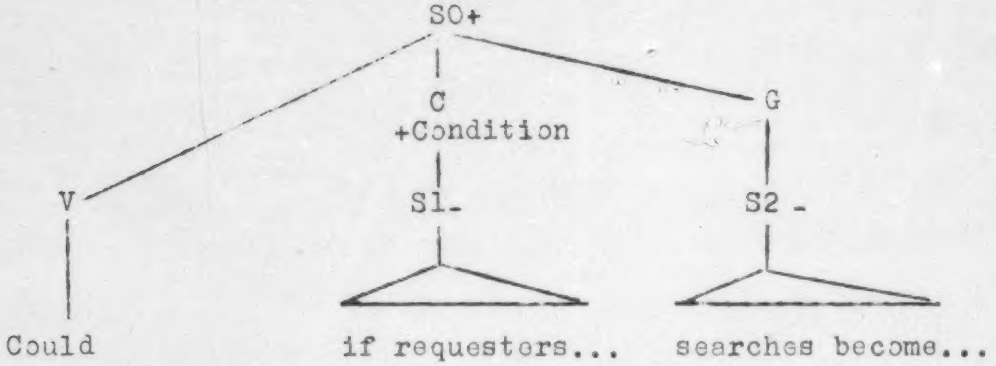
Example : ... it is possible... BY searching one item to receive information on all compounds of the same type (J 260).

(44)


SO+
V
C
G
S1 -
S2 -
is unable
selection...
to produce the retrieval selective results...

Example : (It is shown that) selection according to "NOT" is unable to produce the retrieval selective results ordinarily claimed for this operation... (J 680).

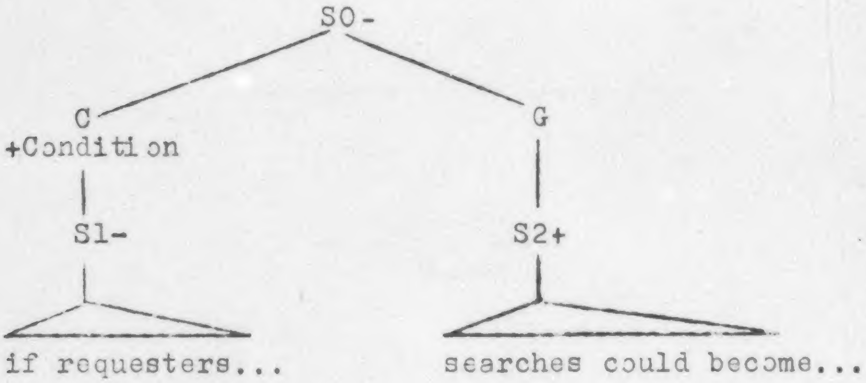
(45)


SO+
C
+Condition
G
V
S1-
S2 -
Could
if requesters...
searches become...

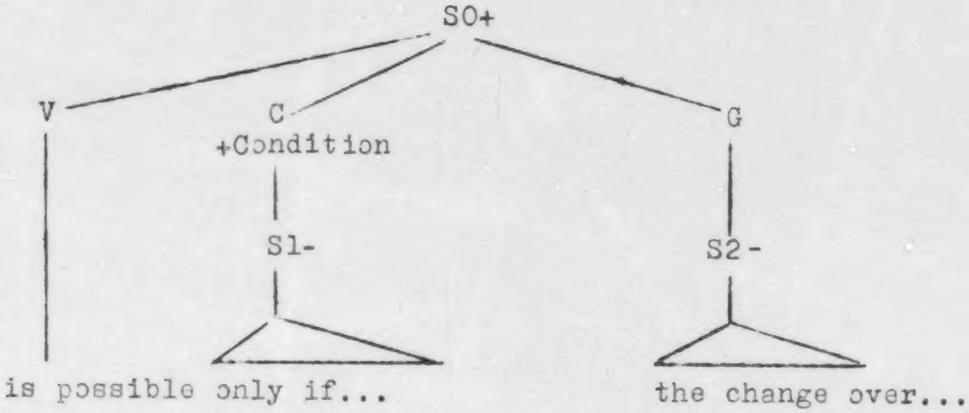
Example : Searches could become more effective if requesters designated a plurality of pertinent subject headings arranged according to importance (J 266).

(46)

Alternative analysis

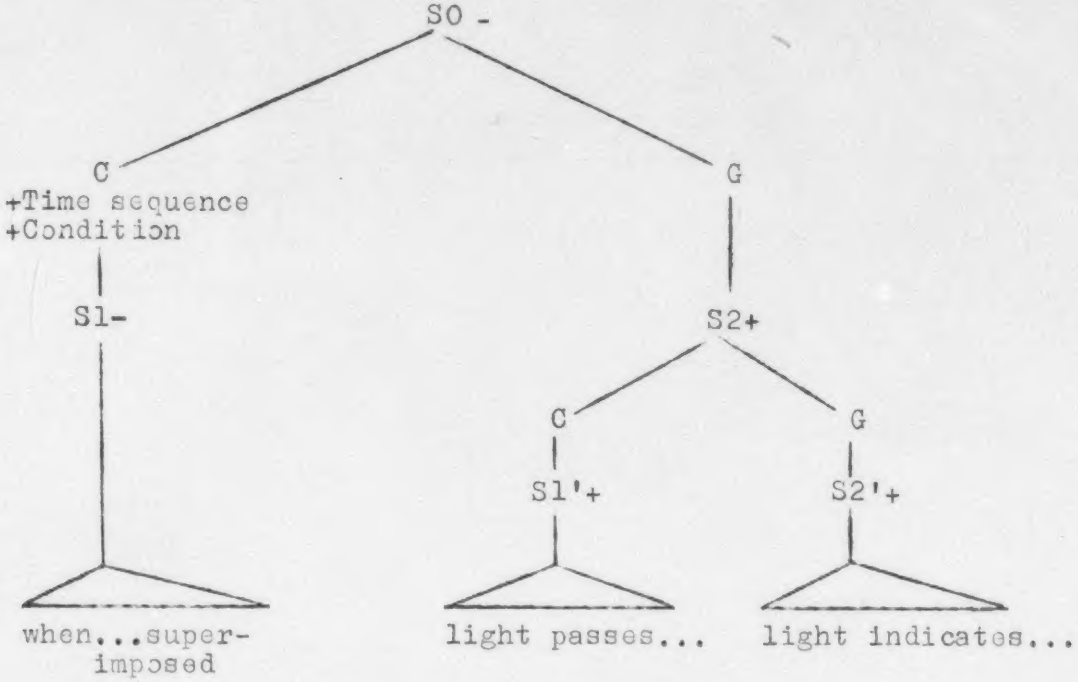

SO-
C
+Condition
G
S1-
S2+
if requesters...
searches could become...

(47)


SO+
V
C
+Condition
S1-
G
S2-
is possible only if...
the change over...

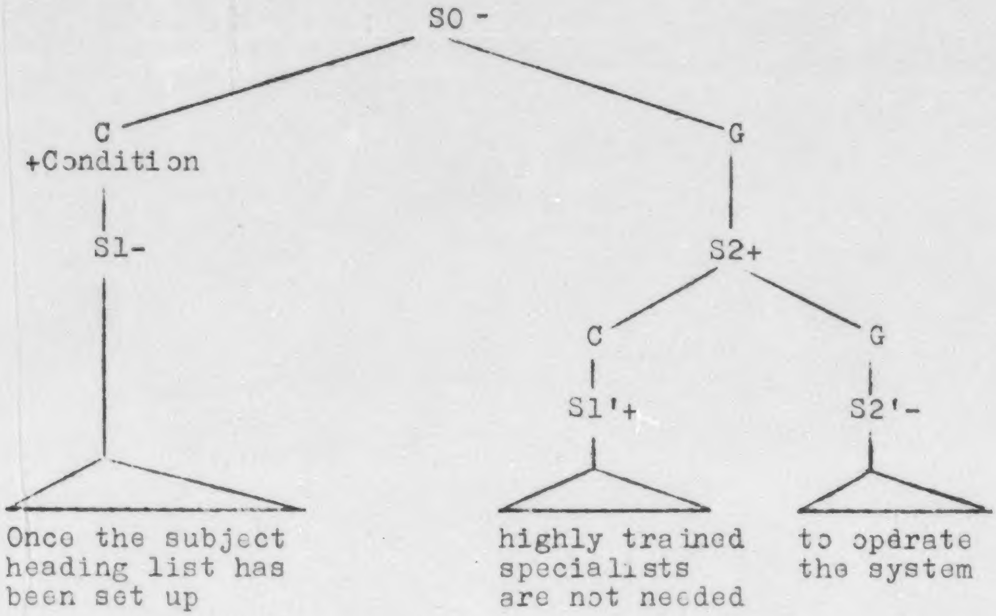
Example : (In the system) the changeover to mechanical selection is ONLY possible IF a previously defined list of concepts is available (J 537).

(48)


SO -
C
+Time sequence
+Condition
S1-
G
S2+
C
S1'+
G
S2'+
when...superimposed
light passes...
light indicates...

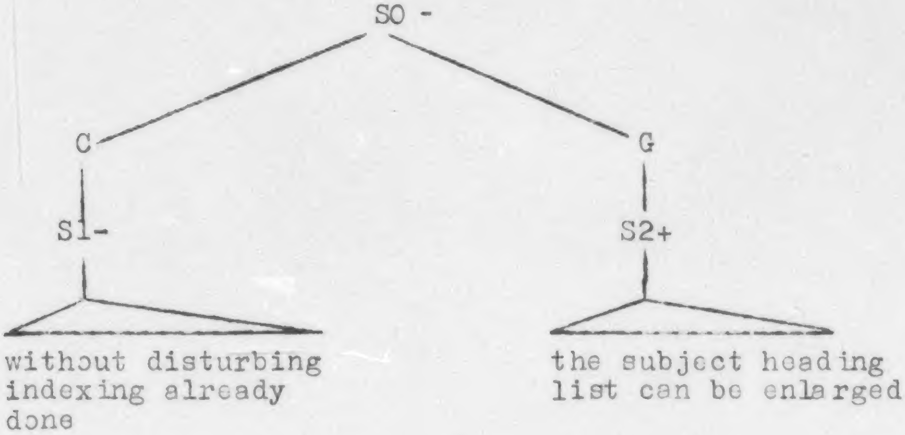
Example : WHEN several subject cards are superimposed, light passes through the holes in the subject cards in that particular pack and indicates which documents pertain to all of those subjects (J 1099).

(49)


SO -
C
+Condition
G
S1-
S2+
C
G
S1'+
S2'-
Once the subject heading list has been set up
highly trained specialists are not needed
to opdrate the system

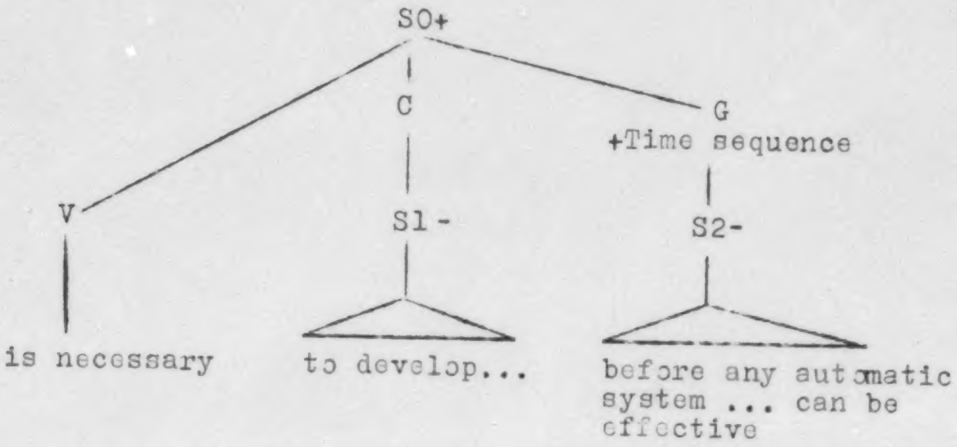
Example : ONCE the subject heading list has been set up, highly trained specialists are not needed TO operate the system (J 843).

(50)


SO -
C
G
S1-
S2+
without disturbing indexing already done
the subject heading list can be enlarged

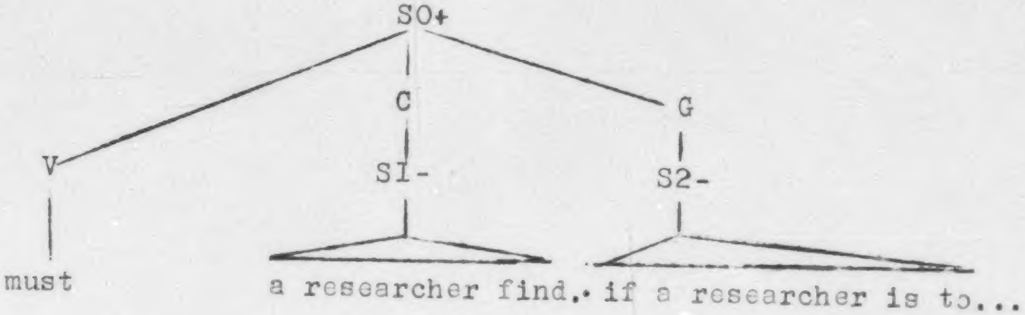
Example : The subject heading list can be enlarged WITHOUT disturbing indexing already done (J 843).

(51)


SO+
C
G
+Time sequence
V
S1 -
S2-
is necessary
to develop...
before any automatic system ... can be effective

Example : BEFORE any automatic system for storing, searching, and retrieval of information can be effective, it is necessary to develop an efficient and economic method of placing and locating the information in the system (J 404).

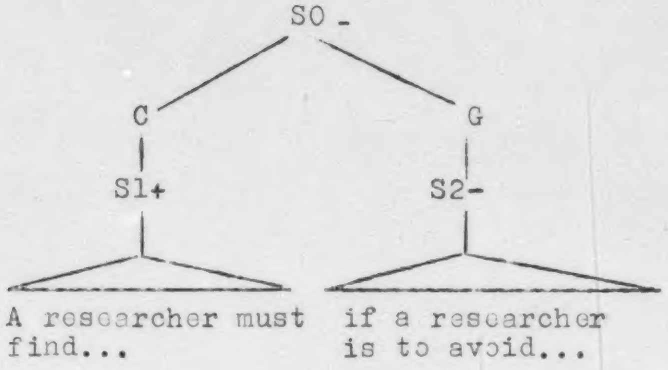
(52)


SO+
C
G
V
S1-
S2-
must
a researcher find.
if a researcher is to...

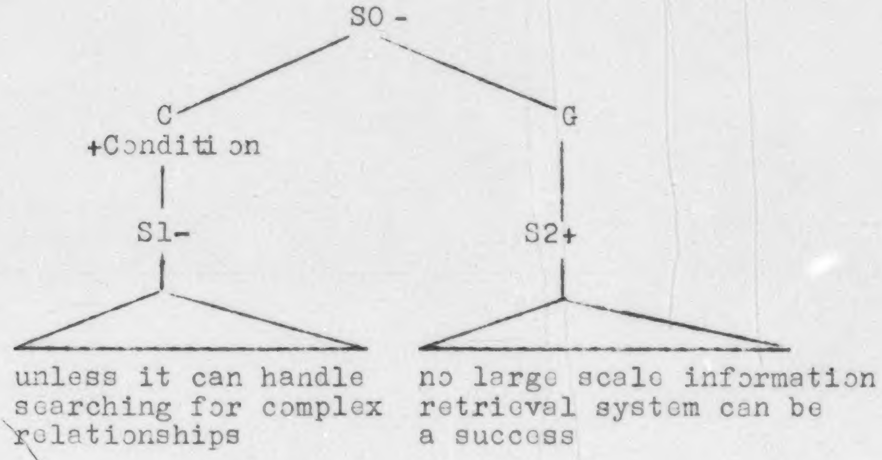
Example : IF a researcher is to avoid duplicating work already done somewhere else, he must find what pertinent work exists anywhere... (J 637).

(53)

Alternative analysis

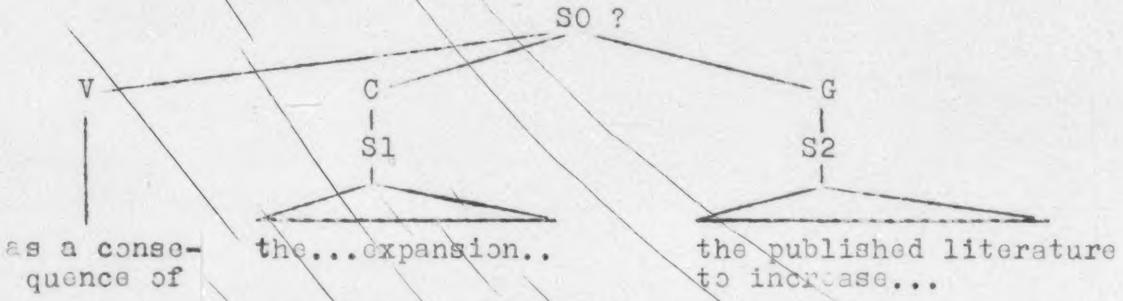

SO -
C
G
S1+
S2-
A researcher must find...
if a researcher is to avoid...

(54)


SO -
C
+Condition
G
S1-
S2+
unless it can handle searching for complex relationships
no large scale information retrieval system can be a success

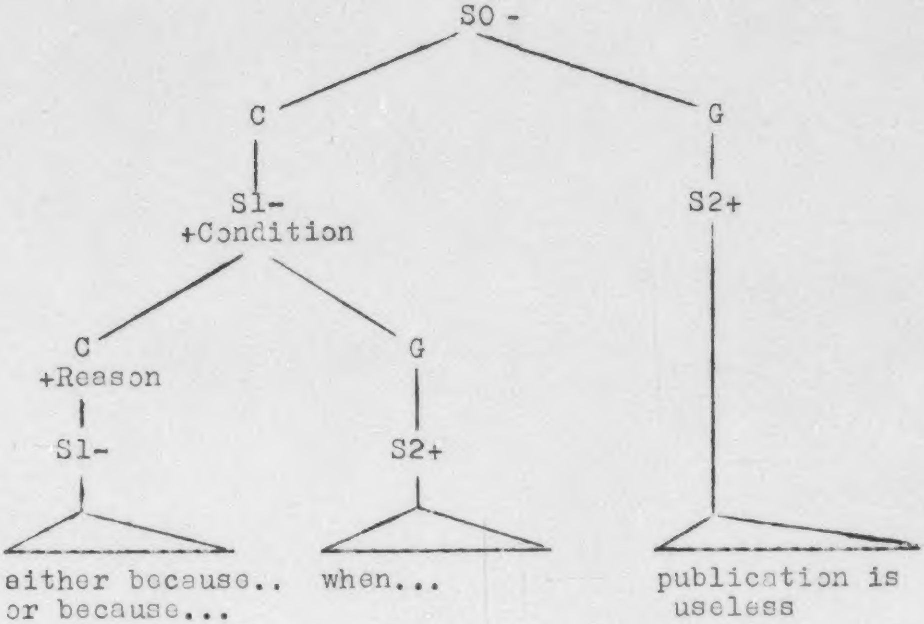
Example : (The writer feels that) no large scale information retrieval system can be a success UNLESS it can handle searching for complex relationships (J 20).

(55)


SO ?
V
C
G
S1
S2
as a consequence of
the...expansion..
the published literature to increase...

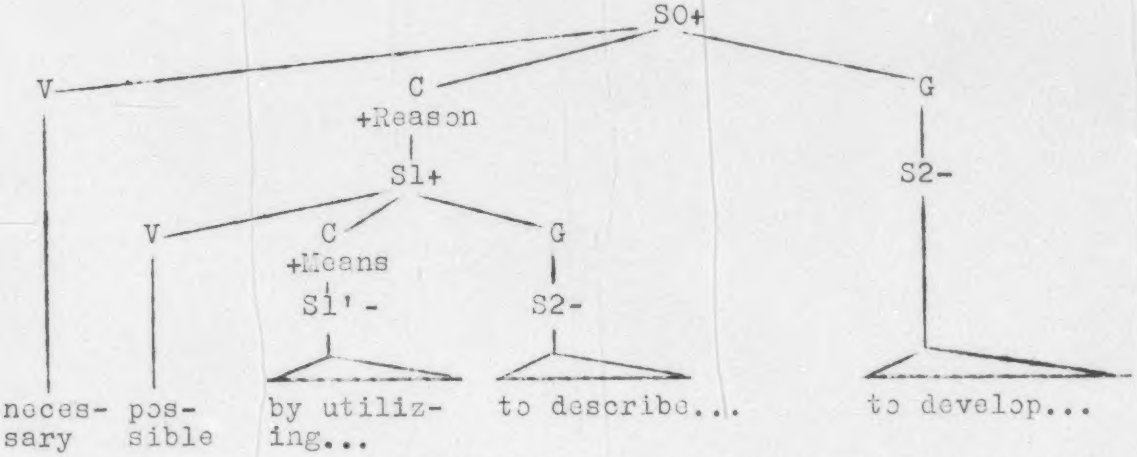
Example : The published literature to increase in quantity and complexity as a consequence of the expected continuous expansion of research activity. (J496).

(56)


SO -
C
G
S1-
+Condition
S2+
C
+Reason
G
S1-
S2+
either because..
or because...
when...
publication is
useless

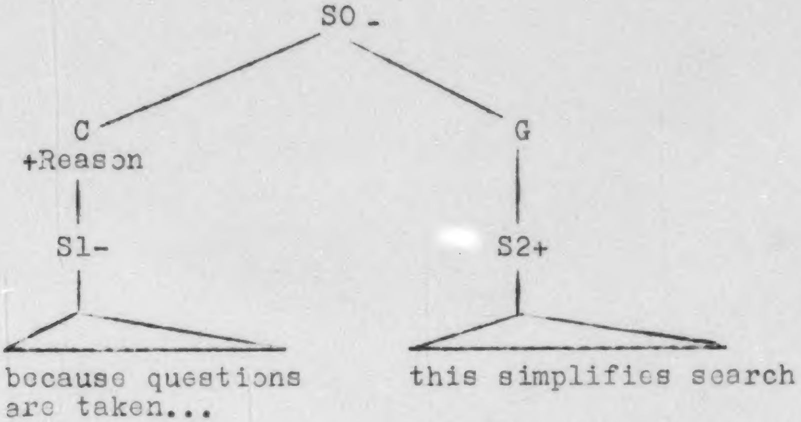
Example : Publication is useless WHEN it neither informs nor entertains, WHEN it solves no old problem or stimulates no new research, WHEN it serves no reference function, either BECAUSE the theme is trivial or the information is already available and accessible in the literature (J 665).

(57)


SO+
V
C
+Reason
G
S1+
S2-
V
C
+Means
G
S1'-
S2-
neces-
sary
pos-
sible
by utiliz-
ing...
to describe...
to develop...

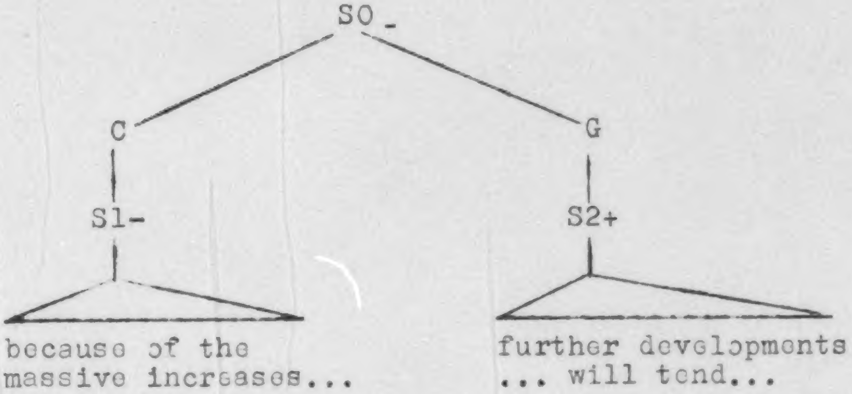
Example : BECAUSE it is possible to describe one concept BY utilizing several different verbal expressions, it (was found) necessary to develop one metalinguistic common denominator for a mechanized information retrieval system (J 707).

(58)


SO -
C
+Reason
G
S1-
S2+
because questions are taken...
this simplifies search

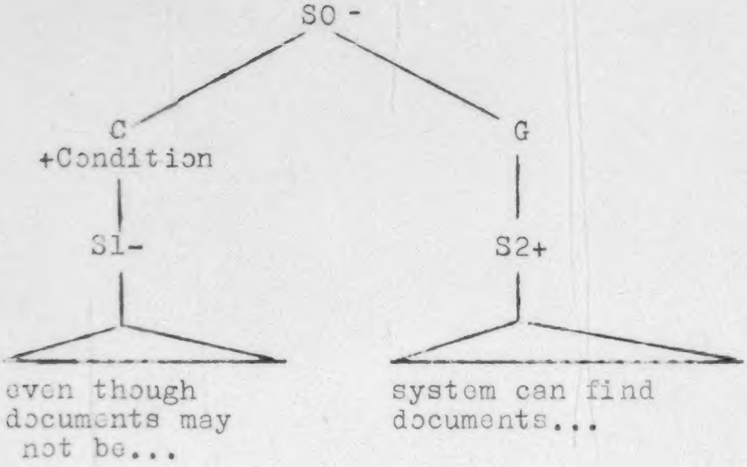
Example : (At... documents are indexed by both UDC and Uniterms). This (...) simplifies search BECAUSE questions are taken directly to the most appropriate index (J 872).

(59)


SO -
C
G
S1-
S2+
because of the massive increases...
further developments ... will tend...

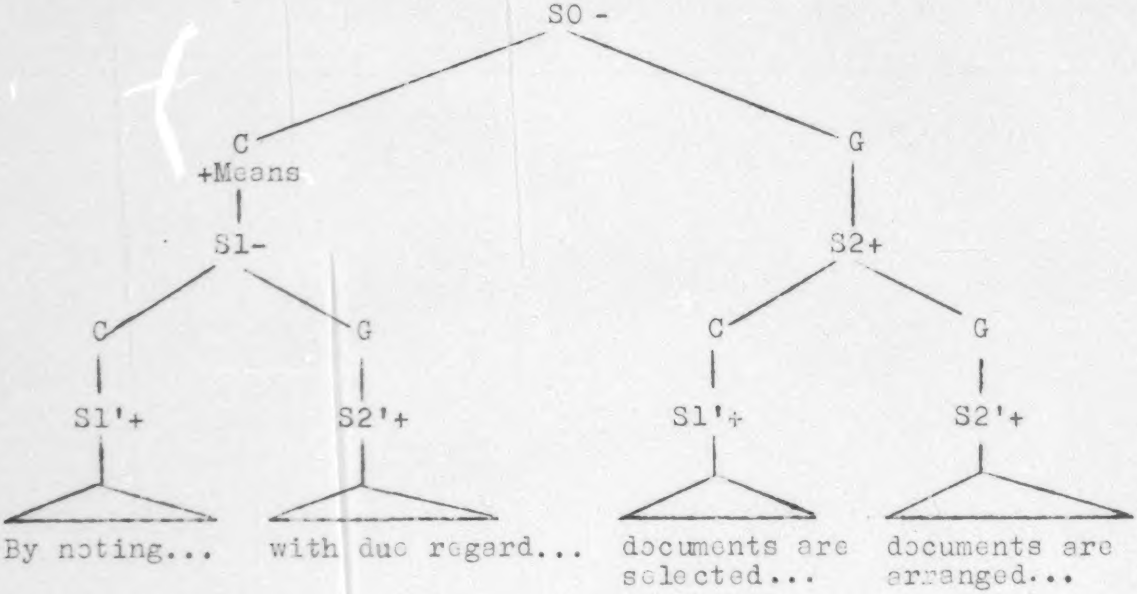
Example : (Predicts that) further developments in documentation will tend to be in the direction of electronic storage units BECAUSE OF the massive increases in the material to be handled (J 785).

(60)


SO -
C
+Condition
G
S1-
S2+
even though documents may not be...
system can find documents...

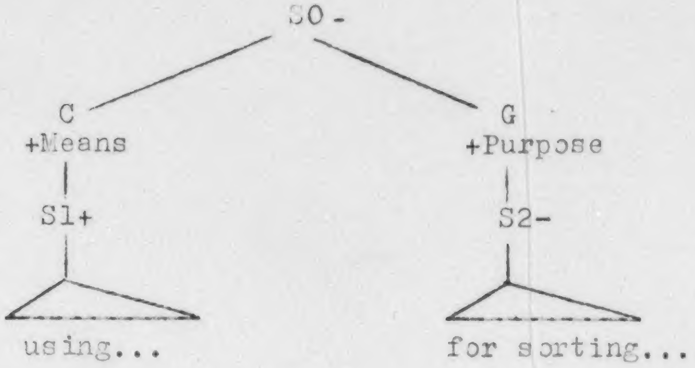
Example : (Describes an all-computer document-retrieval system) which can find documents related to a request EVEN THOUGH they may not be indexed by the exact terms of the request... (J 942).

(61)


SO -
C
+Means
G
S1-
S2+
C
G
C
G
S1'+
S2'+
S1'+
S2'+
By noting...
with due regard...
documents are selected...
documents are arranged...

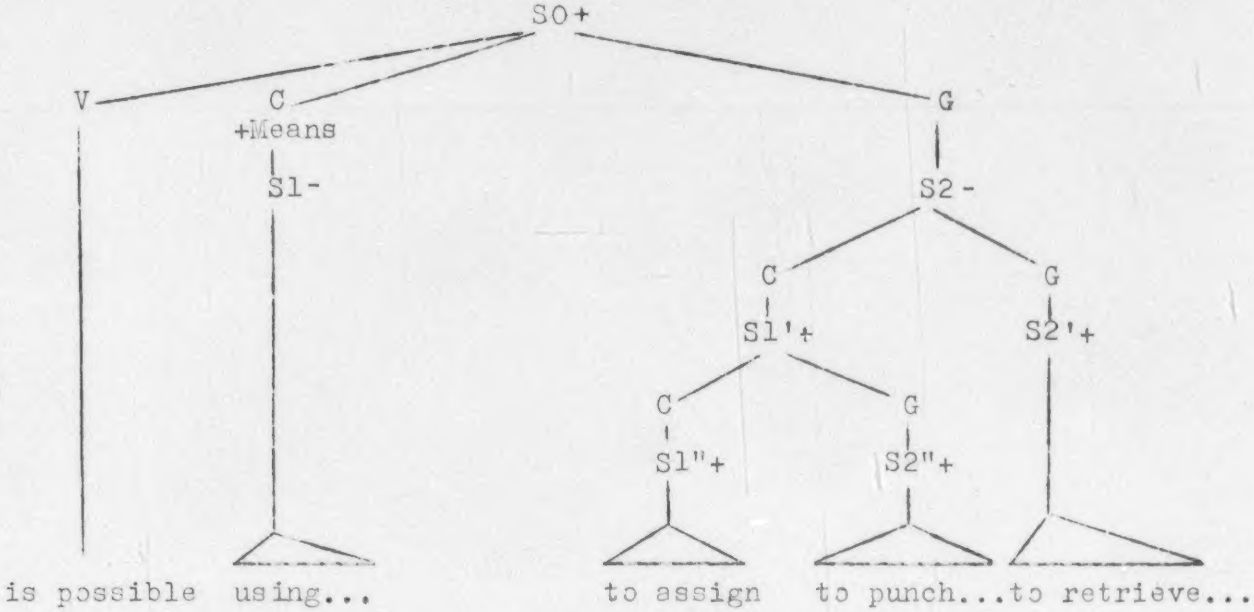
Example : BY noting the number of matching terms between this extended list of request terms and the terms used in indexing a document, and WITH due regard for their degree of association, documents are selected by the computer and arranged in the order of their relevance to the request (J 942).

(62)


SO -
C
+Means
S1+
G
+Purpose
S2-
using...
for sorting...

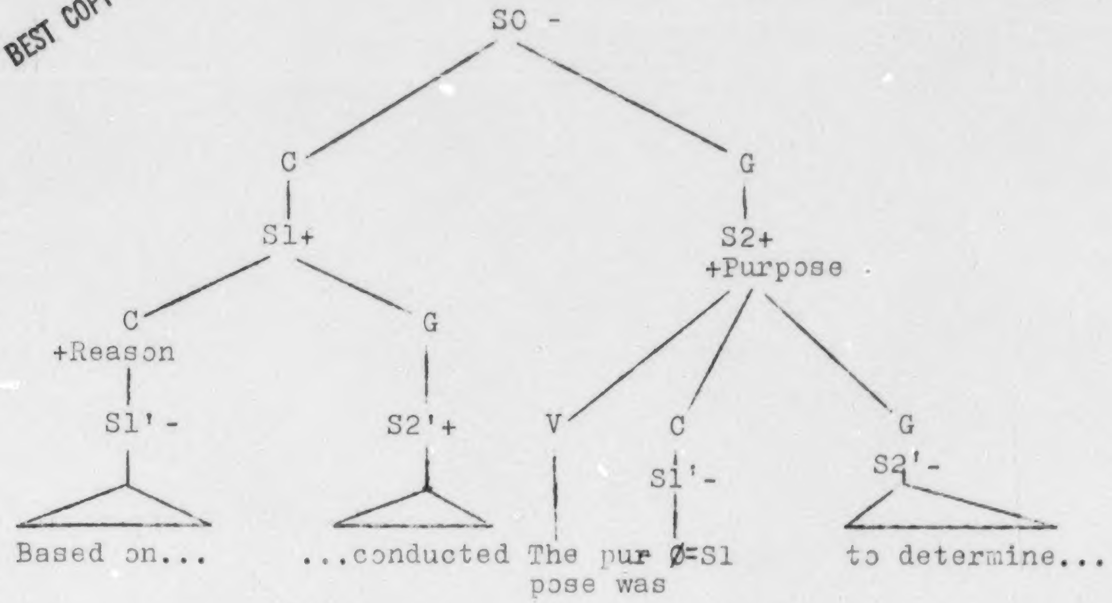
Example : (This proposes) using a high-speed, sequence-controlled digital computer coupled to punched card reading and sorting equipment, called Electronic Structural Correlator (ESC) FOR sorting all chemical compounds containing a specified chemical group (J 231).

(63)


SO+
V
C
+Means
S1-
G
S2 -
C
S1'+
G
S2'+
C
S1"+
G
S2"+
is possible
using...
to assign
to punch...to retrieve...

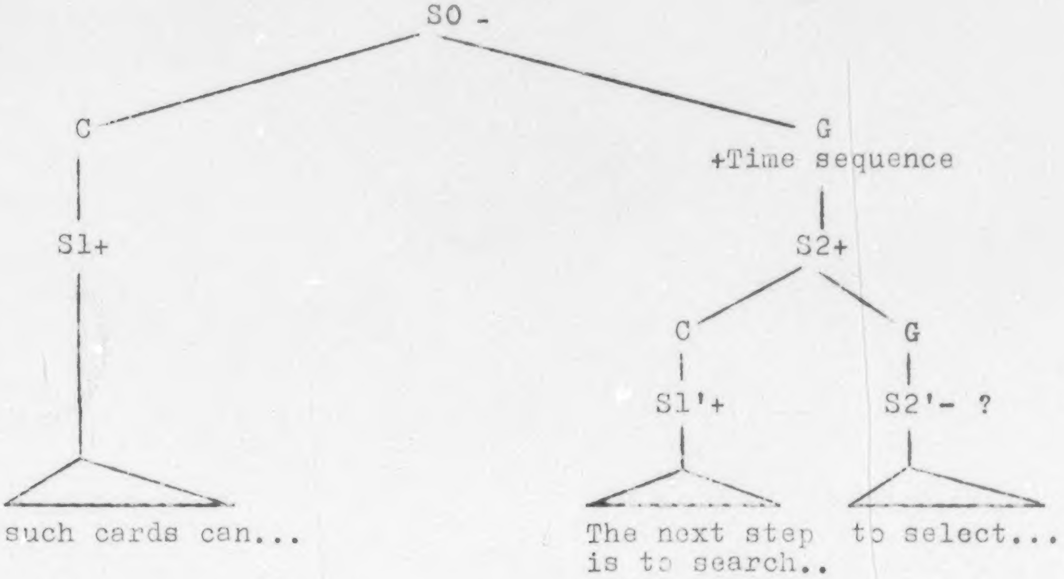
Example: Using the officially accepted International System of Notation of Organic Compounds of the International Union of Pure and Applied Chemistry, a modified IBM 026 Card Punch with document writing feature and an IBM 866 electric typewriter, it is now possible to assign to each organic compound a single mathematically unique group of descriptors, AND to punch these into a card AND retrieve the original cipher in typewritten form at the rate of 600 characters per minute (J 273).

(64)


SO -
C
G
S1+
S2+
+Purpose
C
+Reason
G
S1'-
S2'+
V
C
G
S1'-
S2'-
Based on...
...conducted
The pur pose was
Ø=S1
to determine...

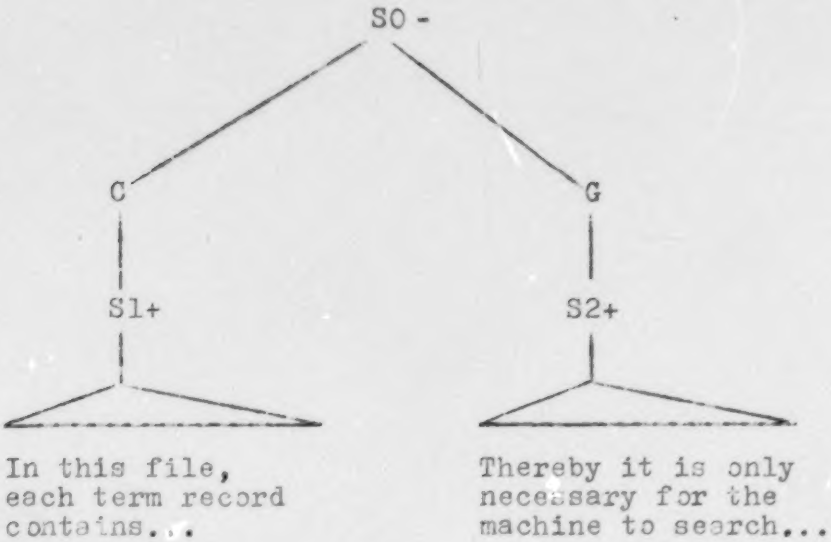
Example : Based on the growing interest in cooperative effort of abstracting agencies, Herner and company (...) conducted a survey (...) The purpose was to determine if and how... (J 412).

(65)


SO -
C
G
+Time sequence
S1+
S2+
C
G
S1'+
S2'- ?
such cards can...
The next step is to search..
to select...

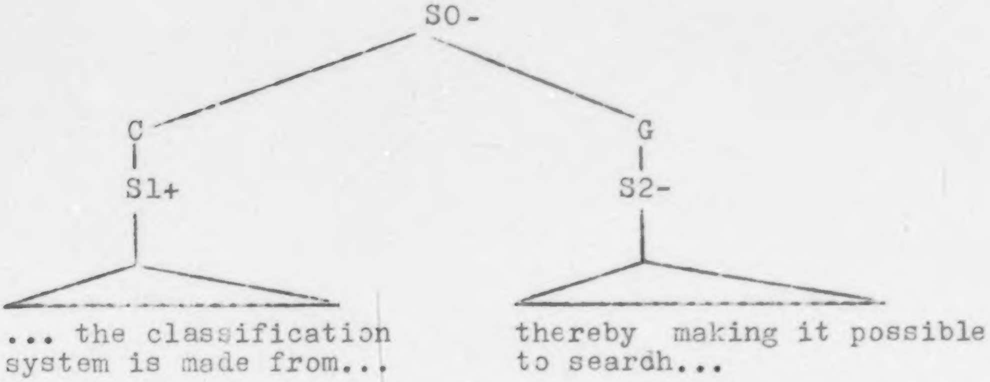
Example : Such cards can easily be turned into a magnetic tape. The next step is to search the tapes for fractional structures and so to select chemical types of a predetermined character from the stock (J 273).

(66)


SO -
C
G
S1+
S2+
In this file, each term record contains...
Thereby it is only necessary for the machine to search...

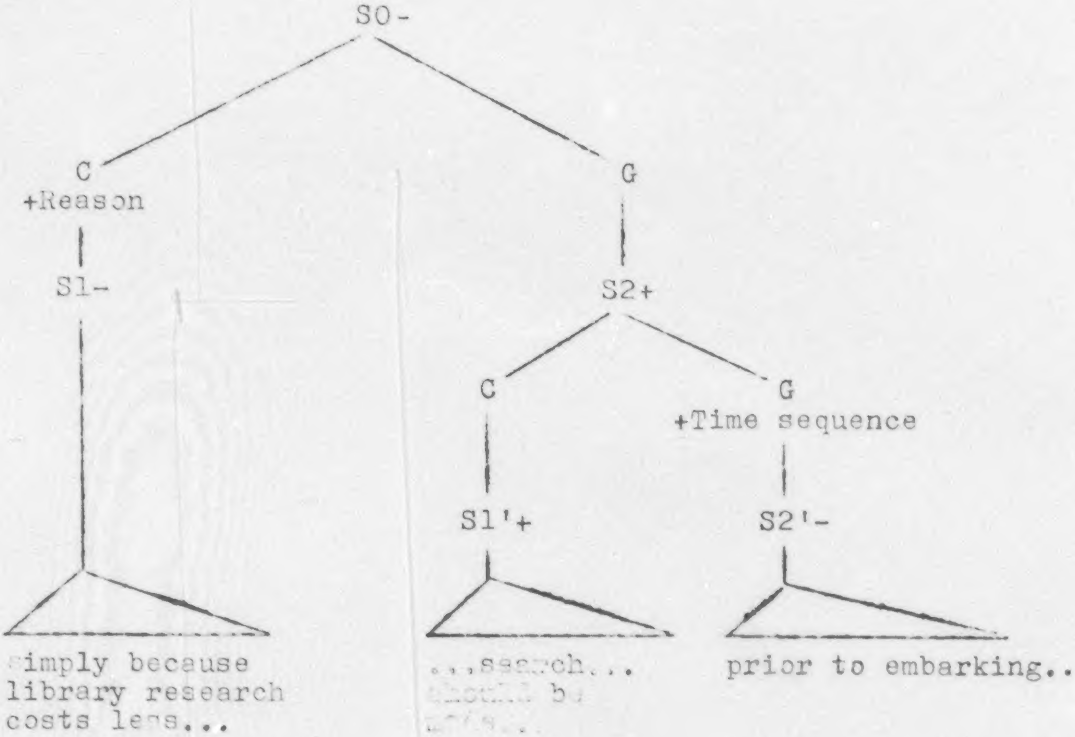
Example : In this file each term record contains all of the document codes for all of the documents in which the term appears. Thereby it is only necessary for the machine to search the pertinent terms in the machine's memory (J 9).

(67)


SO-
C
G
S1+
S2-
... the classification system is made from...
thereby making it possible to search...

Example : In this system, the classification system is made from the disclosures in the patent literautre, thereby making it possible to search for all the information in the file of interest to the searcher (J 19).

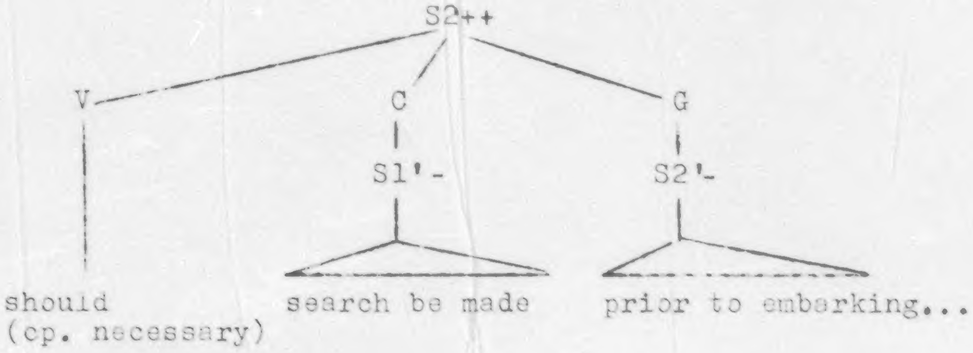
(68)


S0-
C
+Reason
G
S1-
S2+
C
G
+Time sequence
S1'+
S2'-
simply because library research costs less...
...search... should be made...
prior to embarking..

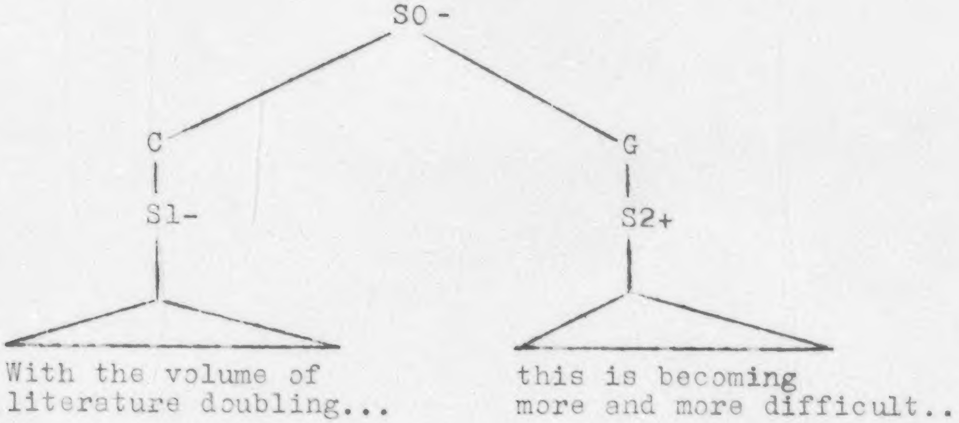
Example : Prior to embarking on a laboratory project, a thorough search of available literature should be made, simply because library research costs less than laboratory research (J 889, sentence 1).

(69)

Alternative analysis of S2 in (68)


S2++
V
C
G
S1'-
S2'-
should
(cp. necessary)
search be made
prior to embarking...

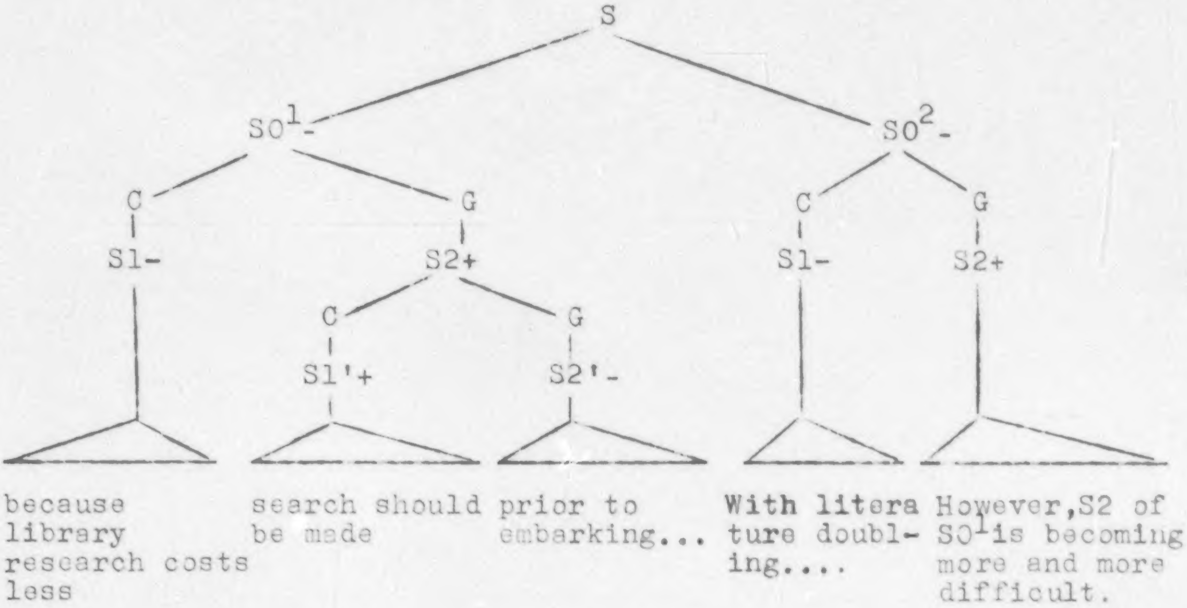
(70)


SO -
C
G
S1-
S2+
With the volume of literature doubling...
this is becoming more and more difficult..

Example : (However,) WITH the volume of literature doubling every ten to fifteen years, this is becoming more and more difficult (J 889, sentence 2).

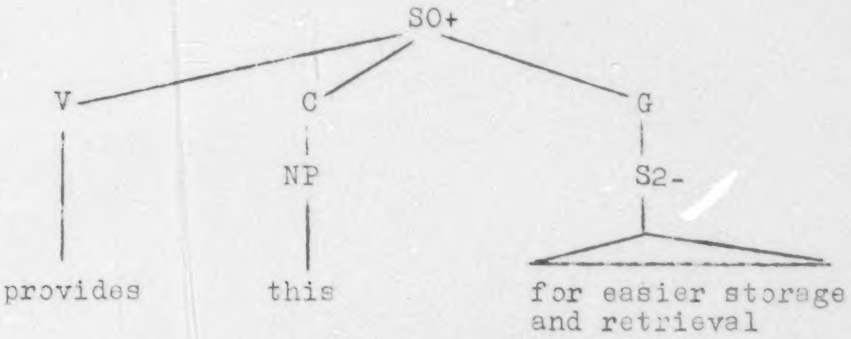
The last trees are intended to suggest a possible relevance of my analyses to discourse structure. Thus, bringing (68) and (70) together, the first two sentences of J 888 would be represented as follows, ignoring the problem of how to represent 'however' :

(71)


S
SO^1-
SO^2-
C
G
C
G
S1-
S2+
S1-
S2+
C
G
S1'+
S2'-
because library research costs less
search should be made
prior to embarking...
With literature doubling....
However,S2 of SO^{1}is becoming more and more difficult.

A similar application to discourse structure is possible in the first two sentences of J 390; in the second sentence which is diagrammed below, *this* refers to the kernelization of texts mentioned in the first sentence and can be analyzed as C :

(72)



Example : (Concerned with the idea that) a text (...) may be reduced to a sequence of kernel sentences which convey the same information as the original piece of work. This *provides for* easier storage and retrieval (J 390).

The above example suggests two remarks. First of all, suppose we had '*facilitates*' instead of '*provides for easier...*' This presents a difficulty for case theory as it currently stands : '*storage and retrieval*' would presumably have to be analyzed as the Object of '*facilitates*'. The only way to correct this deficiency while preserving the general principles of case theory is to resort to meaning postulates : for instance, PROVIDE (C, G = *easier S*) = FACILITATE (C, O = S). Similar postulates would be needed for other causative verbs such as '*simplify*' (= MAKE + Goal = *simpler S or NP*) as in the following example : "Advances in linguistics could greatly *simplify* the unsolved and growing problem of formulating and communicating new knowledge" (J 1027). In fact, this property of causatives seems to be so general and causatives are such an important class of verbs that some kind of general rule similar to a redundancy rule seems to be necessary. This rule would state that Causative + Object implies CAUSE + (the corresponding non-causative + Object (or, if necessary, some other case)) as a Goal.

Second, in the example of (72) ("This provides for easier storage and retrieval"), 'This' stands for a sentence. This suggests that in many of the analyses so far presented (particularly those marked SO + because their surface form has a predicate such as "provides") what has been written as S should in fact be written as NP = S, that is NP rewritten as S. In such cases then, the S I have used so far must be regarded as a notational simplification.

To conclude, I would say this . The analyses proposed in this and the preceding section are obviously different from those so far proposed within case theory. Except in sentences of the type "The purpose of—— is to——" (39), I see no reasons for extending the system I propose to the type of 'simple' sentences usually analyzed by Fillmore and his followers, or for giving up the type of representations they propose for 'simple' sentences. I shall therefore assume the validity of these representations in what follows. What I do feel, however, is that the type of representation I propose is justifiable by the generalizations it captures. Moreover, the 'simple' sentences find their place in my system as exponents of S1 and S2, in which Fillmore's case structures can in turn find their place. Evidence for such a conception is the following sentence (73), which was analyzed above in (61). As far as I can see, Fillmore would analyze the by- and the with- phrases in this sentence as Instrument. But this would result in a violation of his principle that "each case relationship occurs only once in a simple sentence" (Fillmore 1968a, 21), since another Instrument ("by the computer"), which I cannot see how to relate to the by- and with-phrases, is associated with the verb of the main sentence ("are selected"):

(73)

> By noting the number of matching terms between this extended list of request terms and the terms used in indexing a document, and with due regard for their degree of association, documents are selected by the computer and arranged in the order of their relevance to the request (J 942).

Under the analysis I propose, this sentence is not a violation of Fillmore's principle.

3.5. SOME COMPLEX INSTRUMENTS.

3.5.1. "Machine" and "system" as Instruments.

Case theory as it currently stands recognizes the following types of Instruments :

(i) 'Simple' Instruments : for instance, '*the key*' in "*The key* opened the door" and in "John opened the door *with the key*" (Fillmore 1968a, 25).

(ii) Corresponding constructions with the verb '*use*', as in "John used *the key* to open the door" (*loc. cit.*). Fillmore, however, has never published an analysis of such sentences. He has merely suggested in lectures that the grammatical object of an active sentence with '*use*' is to be analyzed as an Instrument (Fillmore 1970b). Langendoen, who has adopted some of Fillmore's proposals, suggests to analyze the verb '*use*' as "a three-place predicate, whose arguments are an agent, an instrument, and an infinitival clause expressing what may be called result". This clause in turn is analyzed as containing a predicate (e.g. '*open*'), an agent and another case (e.g. the object '*door*'). Langendoen proposes to capture the relatedness between the sentences with '*use*' and corresponding sentences of the type given in (i) by assigning them the same structure, the only difference being that sentences such as "John opened the door *with the key*" have an abstract instrumental predicate without lexical realization (Langendoen 1969, 106-7).

(iii) Instruments such as the subject of '*proved*' in "*The fact that he had blood on his hands* proved that he was guilty" (Stockwell *et al.* 1968, 10; cp. Fillmore 1970b).

(iv) Compound instruments, which are described as "containing a possessed noun as the Instrument (the car's fender)", and as allowing two possibilities of subject selection: compare "The car broke the window with its fender" and "The car's fender broke the window". "A similar explanation is suggested for" : "Your speech impressed us with its brevity" and "The brevity of your speech impressed us" (Fillmore 1968a, 23).

In this chapter, I wish to discuss types of Instrumental constructions which to my knowledge have never been examined within case theory, as well as some conceptual dependencies between Instruments, which are in certain respects similar to, and in other respects different from Fillmore's example with "the car's fender". The need for such a discussion in this study will become apparent as soon as one remembers Webster's definition of 'documentation', which is repeated in (1) (a), and a possible paraphrase of it given in (1) (b), in which I have capitalized the Instrumental predicates and underlined what would presumably be analyzed as Instrument by Fillmore :

(1)

(a) the assembling, coding and disseminating of recorded knowledge comprehensively treated as an integral procedure utilizing semantics, psychological and mechanical aids, and techniques of reproduction including microcopy for giving documentary information maximum accessibility and usability.

(b) a procedure which UTILIZES semantics, psychological and mechanical aids, and techniques USED for reproduction, and which is USED for the assembling, coding and disseminating of recorded knowledge, and for giving documentary information maximum accessibility and USABILITY.

In this section, I shall be concerned with the status of 'machine', 'system', and equivalent words as Instruments. I shall make use of five criteria for establishing the Instrumental status of these words. The first two criteria have been used in combination by Fillmore and others; I believe, however, that the other three are equally useful.

(a) 'Machine', 'system', and equivalent words function as subject of various verbs.

(b) In prepositional phrases, they are introduced by prepositions that are typically associated with Instruments in English.

(c) They function as grammatical object of verbs like 'use' in active sentences.

(d) There are morphological formations with -er and -or which are ambiguous between Agent and Instrument in the same way as are grammatical subjects. In the Instrumental reading, these suffixes are equivalent to 'machine' or 'system' : for instance, "technical translator" (J 438, Agent), versus "automatic translator" (J 724, Instrument). Compare the following advertisement : "Don't BE a dishwasher, BUY one".

(e) Lastly, there are some nominal groups in which the Instrumental analysis seems to be relevant to word order.

(a) to (e) must be regarded as a 'battery' of tests, in which each separate test or criterion is necessary next to the others. Evidence for the relatedness of the five constructions can be found in the existence of texts like the following (2 a and b), in which two or more such constructions cooccur and have a related meaning. The fact that 'machine' and 'system' can be conjoined (as in 2 e) is evidence for their relatedness. In (2) (d), 'method' is used with the preposition 'by' in an active sentence, and as object of 'employ'.

(2)

(a) A review is given of the progress in research and development on the application of high-speed digital computers to language translation (e.g., Russian to English). An attempt is made to determine (1) how machine translation can be accomplished, (2) what the principal achievements are thus far, and (3) what more is required. Machine translation (MT) is defined as the art of translation from one natural language into another, by means of an automatic computer (J 276).

(b) On the recognition of information with a digital computer.
The author analyzes the problem of data recognition by computer, in particular for "table look-up" procedures, taking into account the questions of permissible error by the computer and the permissible errors in data which the machine may be required to recognize, in the nature of NW YRK as recognizably New York. The author concludes that a completely comprehensive recognition system, allowing for all possible errors, will probably prove uneconomical. He suggests that the root of the problem is in the necessity for the computer to examine each character individually and serially, as opposed to the human capacity to scan a whole word or phrase for recognizable patterns. He suggests further that ultime solution may lie along the lines of an analog based on the harmonic patterns of the word or phrase (J 340).

(c) Machines and systems for the modern library.
The major portion of this paper is devoted to an examination of the fundamentals involved in the various existing machines, and systems as applied to modern libraries, and to descriptions of the machines and systems and "their areas of applicability". Among the systems discussed are Batten on Peek-a-Boo cards, the Coordinate Indexing system, telegraphic code, and the system used for indexing the field of steroid chemistry. (J 1065).

(d) Methods by which research workers find information (...) what methods scientists employ in obtaining information... (J 298).

In the examples listed below, I have found no decisive evidence for or against an analysis of 'machine' or 'system' as Cause, the case label proposed by Langendoen for "instrument-like expressions" in sentences having no "understood agent" (Langendoen 1970, 74). I have found no example in which it was possible with any certainty either to rule out or to establish the presence of an implicit Agent. I shall therefore not examine the possibility of a 'Causal' analysis of 'machine' and 'system' in this section.

Let us first consider a few attested examples of 'machine' and 'system' (and occasionally some equivalent words) functioning as subject. In the examples of (3) 'machine' is the superficial subject and in the examples of (4) it is the subject of a clause in which Equi-NP deletion can be thought to have operated. The word 'machine' and the verb of which it is the subject are underlined in the examples. In (4). I have avoided quoting examples with 'for' + infinitive because they may be interpreted in two ways and therefore provide no clue for the status of 'machine' as subject. Thus, 'machine for scanning...' is relatable to 'machine for people to scan... (with)', as well as to 'machine which scans...'. Also compare what I believe to be an indication of the Instrumental status of 'machine' in (4d) ("the machine is able to do...") with the following example which I believe to be non-critical : "This punched-card system enables information to be retrieved..." (J 440). Similar examples with 'system' as subject are given in (5) and (6).

(3)

(a) No machine now commercially available can do the job [of indexing and searching] efficiently (J 444).

(b) This paper attempts to develop formal distinctions between a machine that passively classifies its inputs into predetermined categories and one that develops its own classificatory scheme (J 483).

(c) A machine that does research (J 500).

(d) The machine can search for any combination of a number of coded characteristics or even for their absence (J 504).

(e) This machine, called the universal card scanner, scans cards ... (J 609).

(f) The machine for scanning these encoded cards can search up to 700 cards per minute (J 854).

(g) ... the fears that machines will mechanize the human mind... (J 866).

(h) Machines alone can never solve the fundamental problems of information storage and retrieval (J 344).

(i) In such a system, machines are powerful tools which, under the guidance of human judgement, can do routine operations that free the creative talents of man (J 436).

(j) ...machines which can provide essays on any given subject upon request (J 683).

(k) ... each machine performing efficiently one of the stages in the operation (J 684).

(l) Thereby it is only necessary for the machine to search the pertinent terms in the machine's memory (J 9).

(m) A computer which finds the subject category...(J 639).

(4)

(a) ... the ability of a machine to adequately determine information relevance depends strongly on its ability to recognize and manipulate the syntactic structures of the text (J 176).

(b) ... the permissible error in data which the machine may be required to recognize... (J 340).

(c) An electronic machine that answers the requirements of information retrieval by scanning of punched-cards... (J 609).

(d) However, this machine is able to do more than the scanning and selecting operations described (J 770).

(e) A description of an automatic microfilm searching machine designed to increase searching speed, to edit out extraneous matter, and to provide copies of the desired information (J 1109).

(f) ... there is a need for both the high-speed input machines to handle the bulk of the text transcriptions.. (J 679).

(g) data which the machine may be required to recognize (J 340).

(h) the necessity for the computer to examine... (J 340).

(i) the machine as an instrument for retrieving information (J 943).

(5)

(a) This system handles large numbers of chemical compounds and polymers... (J 275).

(b) ... there is no one system that will handle all knowledge (J 296).

(c) Describes a system which has these features : potential for generic, specific, or combination searching (...) searches compound, process, mixtures and biological data... (J 318).

(d) ... the system would search a million documents (J 689).

(e) system ... which discloses any subject matter (J 704).

(f) system ... working well ... (J 718).

(g) a system of coding by symbolic logic which will not just retrieve information but also create new ideas (J 846).

(h) ... the uniterm system gave slightly better results... (J 872).

(i) what such a system should provide (J 938).

(j) The system cut indexing time, increased retrieval speed, and allowed greater depth of indexing than the subject heading list which had been used previously (J 1119).

(k) Of the two output Systems designed, one stores... and displays it... the second reproduces...(J 37).

(l) no large scale information retrieval system can be a success unless it can handle searching for complex relationships (J 20).

(m) system which can find documents (...) and present these documents (J 942).

(6)

(a) this structure enables the system to : directly interrogate... (J 494).

(b) This system is designed to provide multiple access to ... (J 570).

(c) This system is designed to minimize (...) and maximize.. (J 758).

(d) code system developed to represent chemical structures (J 707).

(e) system devised (...) to accomodate a collection ... (J 848).

(f) system (...) established to retrieve items...

Examples of uses of 'machine' and 'system' and occasionally equivalent words with 'instrumental' prepositions are given below in (7) and (8), and examples of the same words associated with the verb 'use' and equivalent words are given in (9) and (10). Examples with the preposition 'by' have been included in (7) and (8) when the absence of the article and the possibility of a parallel active construction with 'by' or 'with' suggests that we have to do with an instrumental 'by' rather than with the by-phrase of the passive.

(7)

(a) Machine translation is defined as the art of translation from one natural language into another by means of an automatic computer (J 276).

(b) the information can be retrieved by machine (J 321).

(c) Pattern recognition by machine (J 883).

(d) simulating thought processes by machine (J 953).

(e) recognition of information with a digital computer (J 340).

(f) literature searching by machines (J 614).

(g) education by machine (J 683).

(h) The coded information is searched by machine (J 22).

(i) Finding chemical records by digital computer (J 819).

(j) literature searching by machines (J 614).

(8)

(a) By means of this system, it is also possible to search ... (J 273).

(b) Successful searches by this mechanized system... (J 517).

(c) can things be accomplished through using machine-sorted cards which cannot be accomplished through other methods (J 95).

(d) ... to improve searching with the peek-a-boo filing and retrieving system (J 1017).

(e) the desired information is very readily located by means of a simple and practical system (J 1092).

(f) The technique was devised by Stern to improve searching with the peek-a-boo filing and retrieving system used in the reference service (J 1017).

(g) Three thousand structural formulas for encoding (...) were divided into 3 groups of 1000 each. Each group of 1000 compounds was encoded by each of the 2 systems by one each of 3 practising chemists, 3 students working toward the doctorate in chemistry, and 3 undergraduate students majoring in chemistry (J 797).

(g') x Each group of 1000 compounds was encoded by each system and by practising chemists.

(9)

(a) the machine should be simple to demonstrate and use (J 51).

(b) the indexed information is retrieved by using an IBM-101 electronic statistical machine (J 275).

(c) Application of high-speed computers to information retrieval (J 18).

(d) Application of machines in the searching process (J 99).

(e) by 1961 these machines will serve as translators (J 624).

(10)

(a) The application of a punched-card system for indexing rocks and minerals (J 830).

(b) The application of (...) a new classification system to the preparation of an analytical index (J 1111).

(c) system now in use (J 63).

(d) use of the Coden system by the individual research scientist (J 91).

(e) how such a system would operate (J 473).

(f) the way in which the system is operated by the Westinghouse Electric Corporation (J 35).

(g) the peek-a-boo filing and retrieving system used in the reference service (J 1017).

One particularly interesting example is (8g). The critical sentence in this passage shows a clear contrast between instrumental and agentive by-phrases, one following the other, and the sentence corroborates Fillmore's postulate that "only noun phrases representing the same case may be conjoined" (Fillmore 1968a 22).

The facts that are available to me about nominal compounds in -er and -or suggest that, contrary to what a 'lexicalist' may say, they require an abstract treatment such as that first outlined in Lakoff (1968 a), and an analysis in terms of case theory to capture the obvious contrast between the Agentive and the Instrumental meaning of such compounds. My observations here are in agreement with Lakoff's proposal to posit, say, for 'mixer' an underlying structure of the type "a device with which one mixes things and to have an Instrumental nominalization rule deriving nominal compounds in -er or -or for the verbs that allow such a derivation (G. Lakoff 1968a, IV-3), The only counterevidence to the kind of analysis proposed by Lakoff and since then extended by Bach 1968 to all nouns is the existence of expressions like "a human indexer"(J 632 ;

with NO corresponding attested example of "indexer" with an Instrumental meaning). I am unable to explain the occurrence of 'human' here which obviously duplicates 'one' if we posit a deep structure of the type "one who indexes" for 'indexer'.

For the rest, I have found an obvious correlation between the -er and -or suffixes and words like 'machine', 'device' and 'system'. The best-known example is of course "the computer", often referred to as 'a(n electronic) data processing system' or as 'the machine'. Additional evidence for this correlation can be found in various passages like the following (11), in which "system" or some other word such as "element" is relatable to, or refers forward or backward to a word in -er or -or. As is shown in (11 h), these compounds can be used as direct object of the verb 'use', like 'system' :

(11)

(a) Details are given of the Copyflex high-speed printer, and the way in which the system is operated... (J 35).

(b) Advantages of the collator over manual systems (J 1083).

(c) the replacement of alphabetical and numerical coding systems by word indicators (J 235).

(d) the insertion of a machine as storage element and/or selector between contributor and user (J 215).

(e) A description of the Index Searcher (...) which includes a list of 8 design features of the system (J 517).

(f) This machine, called the 'Universal Card Scanner' (...) scans cards... (J 609).

(g) Fact Compiler : a system for the extraction, storage and retrieval of information (J 494).

(h) using punched-card sorters and collaters (J 963).

Various other points would be worth investigating in connection with -er, -or, and other suffixes (e.g. "Findex": J 830). The most important point for the purposes of this discussion is the contrast between Instrument and Agent. Compare, for instance, "automatic/mechanical translator" (J 724, 829, 953) and "technical translator" (J 438)(cp. printer). Occasionally, there exists an Agentive compound next to morphologically different or unmarked Instrumentals, as in "indexer/or (Agent) versus "descriptor" and "index" (cp. store: memory; reservoir, J 851). Also note that some Instrumental compounds seem to have no Agentive counterpart : for instance "(the golden) retriever" occurs only once (J 296), and with an Instrumental value (it is not the dog of our desk dictionaries !). Another morphologically unmarked Instrumental is 'punch' as in "IBM 026 Card Punch" (J 273) and in "Keypunch" (J 728), but "punch machine" (J 728) is also attested.

In most of the Instrumental compounds, the -er/or ending corresponds to words like system, machine, tool, etc. : compare "Scanner" (J 609) and "scanning tools" (J 629). In some cases, however, the ending corresponds to a more specific word : a "descriptor", for instance, can be defined as "a key word or phrase used in data processing to identify an item (as a subject or document)" (Webster's Third Addenda Section). It seems then that the only constant corresponding to the suffix is just the Instrumental role of this ending or of the equivalent word. But now, consider the following attested example : "Research is being done on the development of special small-size machine-translators" (J 624). The analysis I would propose is the following. Since the -or ending is equatable to 'system', the above nominal group can be paraphrased as 'machine translating system'. This is indeed a type of construction which is well attested in the Janaske corpus, namely machine + Ving (or a cognate nominal) + system : for instance, "machine indexing system" (J 401), and other related examples which I shall quote presently. Note, moreover, that while machine + Ving, and Ving + machine are possible and indeed frequent (machine indexing/searching and searching/translating machine, etc.), only Ving + system is possible; system + Ving, as far as I can see, does not exist, and is not attested in the Janaske corpus. This suggests the existence of a linguistically marked hierarchy among Instruments. I shall discuss this topic below (cp. "seven system models", J 681, and "On retrieval system theory", J 1044).

One last argument in favour of an Instrumental analysis for 'machine', 'system' and equivalent terms is the existence of nominal groups, the surface form of which is given in the following table (12). The first position cannot be filled by nouns which can be marked [Human] : for instance, x man (information) retrieval, or x indexer (information) retrieval. On the other hand, for a reason which I am unable to explain, 'human' IS possible in the position usually occupied by Instruments. So are the adjective 'manual' and the corresponding noun 'hand' in the same position. Particularly the last example given in (12) suggests that 'manual' and 'hand' need to be treated as Instruments, like 'machine'. An Instrumental analysis for 'human' may also be considered for examples like the following :"print-out for human searching by eye" (J 256). Such a treatment raises variuus problems, some of which will be discussed below (cp. Fillmore's treatment of an implicit 'body' as both Instrument and object in "John arose": Fillmore 1969b, 136, fn. 8).

(12)

Instrument 1	+ Object	Ving or cognate Nom.	+ "system"	
machine	information	storage and retrieval		J 646
machine	reference	retrieval		J 580
machine		indexing		J 450
machine		retrieval		J 461
machine		translation	techniques	J 766
all-computer	document-	retrieval	system	J 942
machine	literature	searching	systems	J 775
electronic computer	literature	search		J 756
x man		sorting		
human		searching		J 256
manual		searching	tools	J 413
manual		sorting		J 472
hand-		sorting		J 529
manual needle		sorting		J 790
(from)a manual to a machine		indexing	system	J 401

3.5.2. Some problematic examples.

I now wish to examine various situations in which the analysis of 'system','machine', and various other words as Instruments of certain predicates is problematic for a number of reasons. More broadly, I shall discuss some problems arising from the central, axiomatic role which Fillmore assigns in case theory to the [± Animate] distinction in selecting certain nouns or noun-phrases as either Agents or Instruments.

I shall first return for a while to Chomsky 1965. According to the Aspects theory, "John frightened sincerity" is described as "a deviant sentence, formed by relaxing the restriction of frighten to Animate Direct-Objects. Nevertheless, Chomsky feels, there are frames in which this restriction can be violated with no consequent unnaturalness". As examples, he gives various sentences with negations : for instance, "it is nonsense to speak of (there is no such activity as) frightening sincerity", "one can(not) frighten sincerity". Chomsky does not state the (syntactic and semantic) rules by which the "grammar" would indicate that, while 'John frightened sincerity' is deviant, sentences like the above "are not" (Chomsky 1965, 157). Note that in this particular discussion, Chomsky does not allow for intuitions different from his own : for instance, he does not imagine that some people could find it natural to personify "sincerity" in "John frightened sincerity". In fact, elsewhere he suggests to account for personification in terms of violations of selectional rules, which seems to suggest that to him such facts as metaphor are to be handled by the semantic component but are to be described as deviant by the syntax (op. cit., 149). Fillmore, as I have pointed out in 3.1., does grant personification a place in his case grammar, but unfortunately he does not work out any of the details. The same is true of Lakoff's more revolutionary suggestion to set up a theory of "relative grammaticality" which would generate representations of sentences together with the (representations of) the beliefs that make these sentences acceptable - even when they can be found unacceptable under different beliefs or in different contexts (G. Lakoff 1969b and 1971).

Here, I shall adopt George Lakoff's attitude rather than Chomsky's, and I shall examine the question of what extensions of case theory are needed to introduce relative grammaticality into it. Making provisions for different, and occasionally conflicting, beliefs in the theory is necessary in any case, to account for a host of facts which would otherwise have to be ruled out or to await explanation in some suitable component of the theory (for instance, sentences like "*My cat enjoys tormenting me*"), AND to account for *systematic* correlations between such facts (e.g. gender) and matters of belief (Lakoff 1969b, 104-109). Furthermore, if one adopts Lakoff's attitude, the problem of sentences with negations, as are discussed by Chomsky, can be reduced to the problem of sentences without such negations. In fact, it seems more plausible to do it that way than the way Chomsky proposed to do it : one may wonder what is being denied by the negation in "*sircerity is not the sort of thing that can be frightened*" if "*frighten + sincerity*" is labelled a priori as deviant (Chomsky, *loc. cit.*) On the basis of what has just been said, I shall ignore the problem of negation in what follows, in order to concentrate on points relevant to case theory.

The examples from the Janaske corpus which I now wish to discuss have been selected as problematic because they fail to pass two tests which could have been used in the preceding section to establish my Instrumental analyses. As will be seen, my tests cast doubt on the assumption, commonly made in the literature of TG linguistics, that sentences of the type "x uses y to do something" and "x does something with y" are to be given the same deep structure (G. Lakoff 1968b, Fillmore 1968a).

(i) The first test is based on the verb 'use'. Consider the following sentences :

(13)

(a) As a final comment the author adds that one should remember that the machines developed to date are only able to retrieve what has been put into them, nothing more and nothing less.

(b) The machine is neither able to "think" about the information put into it nor able to "forget" obsolete information.

I cannot help feeling that, while (14) (a) below is relatable to (13) (a) and means that the machine does the retrieving, (14) (b) and (c) mean that 'the man' does the thinking and the forgetting, and are NOT relatable to (13) (b) :

(14)

This man uses machines :
(a) to retrieve the information put into them.
(b) to think about the information put into them.
(c) to forget obsolete information put into them.

Also note that (15) (a) is acceptable whereas (15) (b) and (c) to me are dubious (the with-test is to be found in Chomsky 1969b) except perhaps in some queer science fiction context :

(15)

(a) He uses machines to retrieve information *with*.
(b) ? He uses machines to think about information *with*.
(c) ? He uses machines to forget information *with*.

From this, I would conclude that '*think*' and '*forget*' cannot have '*machine*' or the like as Instrument. (No more than Chomsky am I able to provide a justified account for the *with* in (15 a) ; sentences like "* He uses machines to retrieve information *with machines*" are not acceptable whereas "He uses machines to retrieve information *with them*" may be; this suggests that an Instrument could be posited in both the '*use*' and the *to*-clauses).

(ii) The second test makes use of the word '*application*'. I feel that while (16) (a) sounds quite natural, I am unable to understand (16) (b) and (c) :

(16)

(a) his application of machines to the retrieval of information
(b) * his application of machines to thinking about information
(c) * his application of machines to forgetting information.

If I am correct in assuming that verbs like '*think*' cannot have '*machine*' and the like as Instruments, then the selection of the subject of sentences like (13)(b) needs to be made sensitive to differences in people's beliefs. Thus according to some people, only human beings can think, but according to others machines are also able to think. Within current case theory, such differences can only be captured by *both allowing and disallowing* NP's with '*machine*' and the like to function as AGENT of sentences with predicates like '*think*'. I am not familiar with any attempt within case theory to set up feature-changing rules that would, for instance, change a feature [- Animate] into [+ Animate]. What I would therefore propose is a form of lexical entry allowing for mutually incompatible, or contradictory, feature-specifications: thus, a noun like 'machine' would be marked both [- Animate] and [+ Animate] so that its selection as Agent with verbs like 'think' would be both allowed and disallowed, depending on what the speaker wishes to say, and on his beliefs (about 'machines', about 'thinking', etc.).

Because I believe that the underlined verbs fail to pass the two tests just mentioned, I feel that 'machine' functions as Agent in the following sentences given in (17). Note that only the last two passages contain no negation. Also note that some passages are clearly beyond the powers of current theories(for instance, the sentence with intelligence in 17 a); this, however, does not affect my argument.

(17)

(a) The machines do not think but they can now meet nearly all the criteria of intelligence except pattern recognition (J 895).
(b) The myth of thinking machines... premature announcement of what someone expects either he or a machine will do but has not done (J 964).
(c) The machine does not possess a will, and its so-called "conclusions" are only the logical consequences of its input (J 857).
(d) A progress report on machines to learn to translate languages and retrieve information (J 922).
(e) As machines learn they may develop unforeseen strategies at rates that baffle their programmers [= title]. The writer develops the thesis that machines can and do transcend some of the limitations of their designers (J 1096).

Also note that my proposed analysis of 'machine' as Agent can serve to avoid regarding (17) (b) as a violation of Fillmore's principle according to which "only noun phrases representing the same case are conjoinable" (Fillmore 1968a 22) : "either he OR a machine will do". Lastly, I suggest that Langendoen's Cause "role" is not eligible to represent 'machine' in the sentences of (17); this new role or case was set up by Langendoen to contrast with the Agent role, and what we need here, as I have argued, is just the Agent case, to represent the fact that a 'personification' of 'machine' is compatible with the beliefs that some people hold.

I now wish to turn to a second, related, type of situation. So far, my analyses have proceeded under the assumption that the grammatical object of the verb 'use'(or the corresponding of-phrase governed by the noun 'use') are to be analyzed as Instruments; this is the generally accepted analysis in TG literature (Lakoff 1968b, Fillmore 1968a, 25). But surely, 'use' can have the sense of 'employ' as in "Our department uses two typists", and the sense of "behave towards" as in "Use others as you would like them to use you" (Hornby). In addition, consider the following example :

(18)

The use of machines instead of human beings to do the intellectual tasks of abstracting and indexing (J 471).

It seems to me that the reasoning adopted above for "thinking machines" is applicable here. Provision needs to be made for 'human beings', 'men', 'man', etc. to be marked [- Animate] in order to be eligible for selection as Instrument with verbs like 'use' and cognate nominals. The only difficulty which I can see about such an account is that, at least in my speech, it is impossible to say "* The application of machines instead of human beings to abstracting and indexing", although it seems that 'machines' and 'human beings' in this example should also be analyzed as Instrument. At present I can see no way of resolving this difficulty.

The next problematic example I wish to discuss is given in (19) (a). Note that 'select' and 'selection' do pass tests (i) and (ii) : 'we use/apply machines to select information'. I regard (a), (b), and (c) as equivalent for the purposes of this discussion.

(19)

(a) Sentence selection by men and machines (J 816).
(b) Sentences selected by men and machines.
(c) Men and machines select sentences.

What I wish to argue about (19) is this. I believe that Fillmore's principle that only noun phrases representing the same case are conjoinable correctly predicts that (19) (a), (b) and (c) are unacceptable under one interpretation, namely that corresponding to just "men select sentence by (or with) machines". As the full abstract shows, however, what we have here is a comparison between "sentence selection by men" and "sentence selection by machine (methods)" :

(20)

> The formation of abstracts by the selection of sentences. Part I. Sentence Selection by Men and Machines. Auto-abstracting techniques based on high-frequency words show an extremely small variation among themselves in the selection of sentences to form abstracts. Human selection of sentences, although less variable than chance expectancy, is considerably more variable than the machine methods. There was very little agreement between the subjects and machine methods in their selection of representative sentences. Author.
> Part II. The Reliability of People in Selecting Sentences. Although subjects exhibited some reliability in selecting representative sentences, the resultant reliability was low. The lack of inter- and intra-subject reliability seems to imply that a single set of representative sentences does not exist for an article. It may be that there are many equally representative sets of sentences which exist for any given article. (J 816).

We must therefore assume that "sentence selection by men and machines" in this abstract has an underlying structure consisting of two sentences or an equivalent construction with two nominals : something like "sentence selection by men (= A) and sentence selection by (means of) machines (or 'machine methods' (= I) COMPARED".

The last point I wish to examine in this section concerns the prepositional phrases underlined in the following quotations; the predicates which I assume to govern these prepositional phrases are capitalized :

(21)

(a) machines are powerful tools which, under the guidance of human judgment, can DO routine operations that free the creative talents of man (J 436).
(b) the system would search a million documents at a cost of (...), which he compares with (...) as an estimate of the cost of the same WORK with an entirely human agency (J 689).
(c) These machines are USED one after the other, automatically without human intervention, each machine performing efficiently one of the stages in the operation (J 684).

To my knowledge, such 'human' prepositional phrases have never been discussed within case theory, at least in clearly active sentences like (a). Nor has the problem of prepositional phrases with 'without', as in (21) (c). I shall not attempt to examine (21) (b); about this sentence, I would just say that for some reason that no doubt has to do with "entirely", and Instrument is not possible in it : "x the same work done by machine with an entirely human agency". Nor shall I attempt to analyze the other two prepositional phrases internally. All I am concerned with is their case status in the sentences just quoted. In (22) and (23) below I give paraphrases of (21) (a) and (c). These paraphrases suggest that the prepositional phrases under discussion are to be analyzed as Agents. Note in particular that in (22) (a), (b), and (c), "we" or "us" and "under the guidance of human judgment" are redundant, and that (23) (a) and (b) are also dubious for the same reason. Note, furthermore, that (22) (d) is acceptable because, unlike (22) (a), (b), and (c), it does not violate Fillmore's principle that "each case relationship occurs only once in a simple sentence" (Fillmore 1968a, 21).

(22)

(a) * machines are powerful tools which, under the guidance of human judgement, we can use to do routine operations...
(b) * machines are powerful tools with which we can do routine operations under the guidance of human judgement.
(c) * machines are powerful tools which, under the guidance of human judgement can be used by us (documentalists) to do routine operations ...
(d) machines are powerful tools which, under the guidance of human judgements, can be used to do routine operations...
(e) machines are powerful tools which we can use (can be used) to do routine operations under the guidance of human judgement.

(23)

(a) ? They use these machines one after the other without human intervention.
(b) ? The machines are used by them (these documentalists) one after the other without human intervention.
(c) They use these machines one after the other to retrieve information without human intervention.

If my analysis of these prepositional phrases as Agents is correct, an important conclusion can be drawn from (22) (e) and (23) (c): sentences of the type "x uses y to do something" and "x does something with y" are not the same. More precisely, sentences of the former type cannot be regarded as "simple sentences" in Fillmore's sense, and those of the latter type can.

I shall end this section by returning to another important conclusion drawn in it, and by suggesting that it could be extended to other word classes than those I have discussed. I have argued that for certain words the theory should allow for mutually incompatible lexical entries, corresponding to differing beliefs. The conclusion is not merely important as a general theoretical point. It is also important from the more technical point of view of case theory, because one of the claims originally made about this theory was precisely that it *simplified* lexical entries of the type proposed in Chomsky 1965 (see, in particular, Fillmore's paper on 'hitting' and 'breaking' : 1967).

As Fillmore realizes, another class of words which present problems for case theory is what he calls 'human institution' nouns (Fillmore 1968a, 24, fn. 31). The suggestion on which I wish to end is that such nouns also require multiple lexical entries, perhaps via features such as [+ Animate] and [- Animate]. To take the words '*center*' and '*library*' as examples, I suggest that they may be analyzed as Agent in (24) (25), and as Instrument in (26). Also compare the examples of (26) with a much more complex situation, in (27).

(24) At the time of this report, the *Center* was *planning* to change over to a mechanized storage and retrieval system ... (J 1).
(25) Cp. : *They* (the people) were planning/The Center *were* planning

(26)

(a) A system of information systems. Proposes aid to the information crisis through the establishment of a network of information centers... (J 146).
(b) ... in order to increase the holdings at the Center and thereby make it a more effective tool in research (J 127).
(c) Twelve functions of a library viewed as a system of communication are listed (J 599).
(d) ... a pilot center for communicating information... (J 203).

(27)

Directory of R and D information systems;
a listing of centers, services, sources and systems engaged in collecting, storing and disseminating scientific data and information applicable to aerospace research and technology.

This volume presents the findings of a survey of information centers, services, sources and systems collecting, storing and distributing information and data useful in Air Force research and development. It includes descriptions of content and services of each system, and brief instructions for their use. Various search methods are provided for locating information sources pertaining to narrow or broad areas of interest. (J 994).

3.5.3. 'Use' and other instrumental predicates.

For the purposes of this discussion, it will be sufficient to define an instrumental predicate as one whose grammatical object in active sentences with this predicate as main verb can be analyzed as an Instrument, or as any predicate semantically relatable to the former type. In the literature with which I am acquainted, the only instrumental predicate whose existence is recognized and to which some attention has been devoted is the verb 'use'. 'Use', however, is by no means the only instrumental predicate. Among other English instrumental predicates I would mention the following, which I have found in the Janaske corpus :

(28)

apply I
I be available
  be based (up)on I
  depend (up)on I
  derive from I
  draw (up)on I (from I)
  effect, effectiveness of I
  employ I
I go far towards
  importance of I
I have light to shed on
I make (possible, etc.)
  is a matter of I
  operate I
I operate
  refer to I
  resort to I
  start from I
  utilize I
I be a way to

Here, however, I shall not attempt to set up a complete inventory or a detailed analysis of such verbs because I wish to concentrate on what I believe to be a more important problem, namely special properties of USE (and of synonyms like 'employ') which, to my knowledge, have never been discussed.

First, USE accepts what may be called a compound, or double Instrument, which is partly similar to Fillmore's "car's fender" example. As far as I can see, all the sentences given in (29) are acceptable (except when otherwise specified) and they are semantically equivalent, except for the presence or absence of an Agent. Moreover, "the machine" can be regarded as the primary Instrument and "punched-cards" as the secondary Instrument. Corresponding, attested, examples are given in (30). A further possibility of paraphrase, namely 'IN the machine, they use punched-cards', will be discussed in 3.5.5.

(29)

(a) They USE the machine and punched-cards.
(b) They USE the machine with punched-cards.
(c) They USE punched-cards with the machine.
(d) With the machine they USE punched-cards.
(e) The machine USES punched-cards.
(f) * Punched-cards USE the machine.
(g) * With punched-cards they USE the machine.
(h) Punched-cards are USED with the machine.
(i) The machine is USED with punched-cards.

(30)

(a) A concept of documentation ... BASED upon the following procedures (J 851).
(b) The system described EMPLOYS three established techniques (J 35).
(c) The system USES three types of punched-cards (J 19).
(d) They [- punched-cards] can be USED with or without machines (J 328).

Second, there are good reasons to believe that certain verbs - for instance present - do not have Instruments in their case frame. Compare 'The key opens the door', 'This example suggests that' and '* Various examples present the method', as against 'Various examples serve to/are used to/ etc. present the method'. This throws light on an important property of instrumental predicates like USE. They provide a way of introducing simple Instruments into sentences whose main verbs do not accept such Instruments. This is particularly clear with some verbs of the type discussed in 3.1. Consider the following examples :

(31)

(a) Based on the idea that..., he discusses... (J 290).
(a') * The idea discusses...
(b) In addition to defining... by using a simple illustration of..., the author shows... (J 82).
(b') * An illustration defines...
(c) Proceeding from this, the author elaborates with... (J 199).
(c') * This elaborates with ...
(d) Based on the author's findings the report recommends... (J 980).
(d') * The author's findings recommend.

Incidentally, note that the above examples also suggest that certain prepositional phrases such as are exemplified below in (32) could have 'based on' or the like as their underlying structure. Note, in particular, the use of the preposition 'on'. Lastly, note that such expressions are an important mark of discourse structure, since they can refer to all that precedes in a given text.

(32)

(a) On these bases, the paper presents... (J 963).
(a') * These bases present ...
(b) Upon this foundation, he criticizes ... (J 54).
(b') * This foundation criticizes...
(c) On the premise that—, the writer discusses... (J 289).
(d) * The premise that—— discusses...

Another remarkable property of verbs like USE is that simple sentences containing just an instrumental predicate are somehow incomplete : one always uses something TO DO SOMETHING. Now, as already noted, purposive infinitival clauses also occur with non-instrumental predicates. Compare (33) and (34) :

(33)

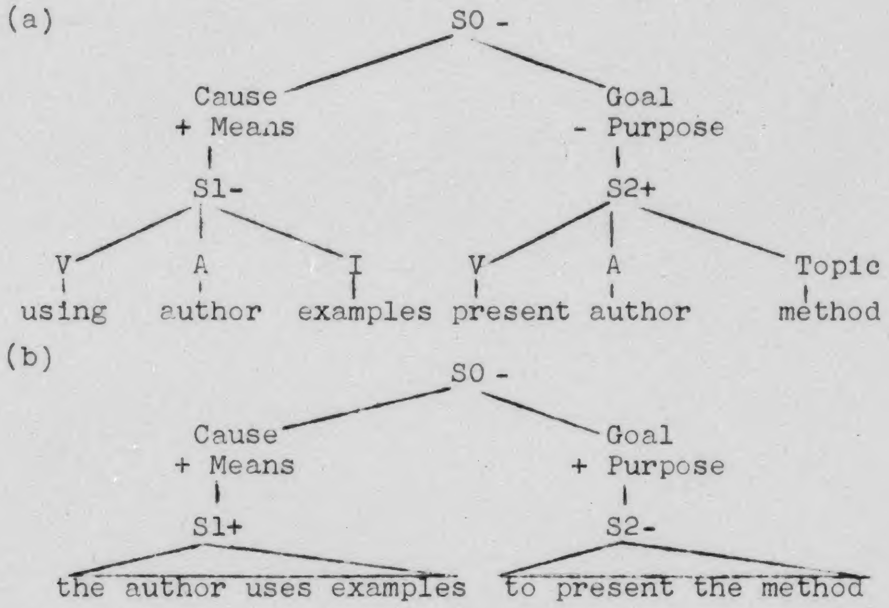
(a) The author presents the method USING various examples (J 330).
(b) The author USES various examples to present the method.

(34)

(a) The author GIVES various examples to present the method.
(b) The author presents the method by GIVING various examples.

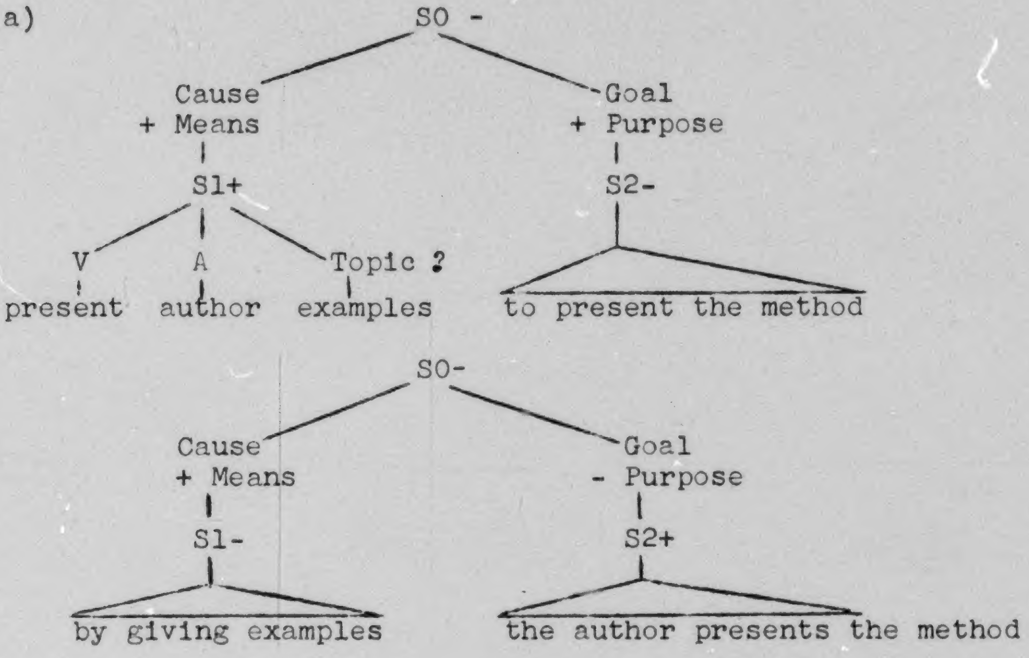
I suggest that a semantic representation of the sentences in (33) and (34) must capture the similarity between them and that this can be done along the lines proposed above in 3.4., as diagrammed below in (35) and (36).

(35)


(a)
S0 -
Cause
+ Means
Goal
- Purpose
S1-
S2+
V
A
I
V
A
Topic
using
author
examples
present
author
method
(b)
S0 -
Cause
+ Means
Goal
+ Purpose
S1+
S2-
the author uses examples
to present the method

(36)

(a)


SO -
Cause
+ Means
S1+
V
present
A
author
Topic ?
examples
Goal
+ Purpose
S2-
to present the method
SO-
Cause
+ Means
S1-
by giving examples
Goal
- Purpose
S2+
the author presents the method

The discussion of the similarities and differences between sentences of the types illustrated in (33) and (34) can be carried a step further by considering the following situations :

	Cause-clause	Goal-clause	Examples
(a)	DESIGN etc. + Goal	I=Goal of Cause-clause	They have designed a machine to retrieve information (with).
(b)	USE + I	I=I of Cause-clause	They use a machine to retrieve information (with).
(c)	(a) + (b)	(a) + (b)	a machine designed *and* used (or: *to* be used) to retrieve information (with).
(d)	USE + I	I different from I in Cause-clause but relatable to it	they use *a machine* to retrieve information with *punched-cards*.
(e)	USE + I	I different from, and unrelated to I in Cause-clause	*the number of matching terms between the list of request terms and the terms used in indexing a document* is used to select the documents *by computer*.
(f)	V + Object	I=Object of Cause-clause	By throwing a stone (at it) he broke the window.
(g)	V + Object which cannot serve as I of Goal-clause together with the I of this clause		He climbed the tree to watch birds with his field-glasses.
(h)	negative		select documents (by sight) without the use of needles

(37) (b) - and, in particular, the possibility of an anaphoric 'with' in the to-clause - suggests that a simple Instrumental or a Cause can be posited in the Goal-clause whenever this is allowed by its main verb. Compare (38) (a) and (b) :

(38)

(a) They use a machine to retrieve information (with).
(b) * They use an example to present the method with.

If this is correct it follows that sentences of the type 'x uses y to V something' and those of the type 'x V's something with y' are equivalent except if the V does not accept a simple I. If it does , the use-clauses can be regarded as a device for 'factoring out' the Instrument and for avoiding its repetition. Compare the attested example in (39) (a) with its paraphrase in (b) :

(39)

(a) the libraries will use machines for cataloguing, indexing, abstracting, cross-referencing, and retrieving of information (J 363).
(b) the libraries will catalogue, index, abstract, cross-reference and retrieve information with machines.

I suggest that (37) (a), (b) and (c) can be analyzed along the lines of my proposals about asymmetric conjunction. Indeed, we have at least the possibilities given below in (40) (a) and (b), which may be compared with the attested examples in (40) (c) and (d). The analyses proposed for (37) (a), (b) and (c) are diagrammed below in (41) :

(40)

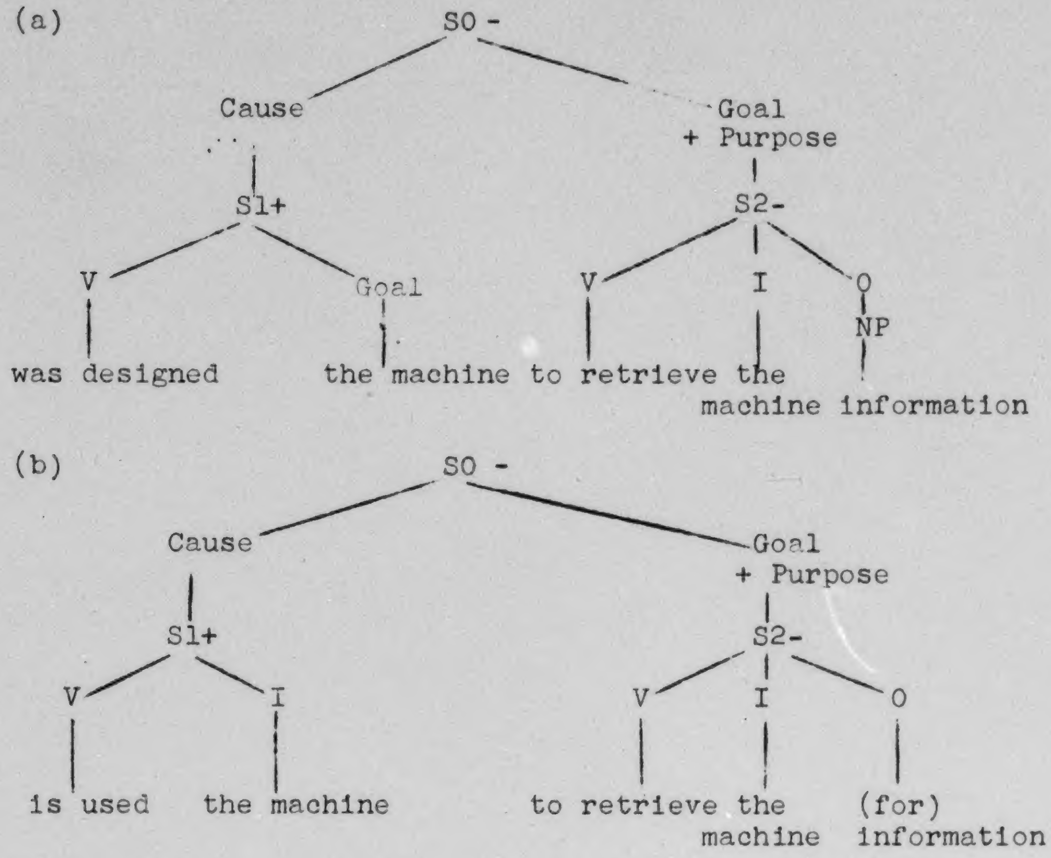
(a) the machine was designed AND is used to search information.

(b) the machine was designed FOR use in searching information.

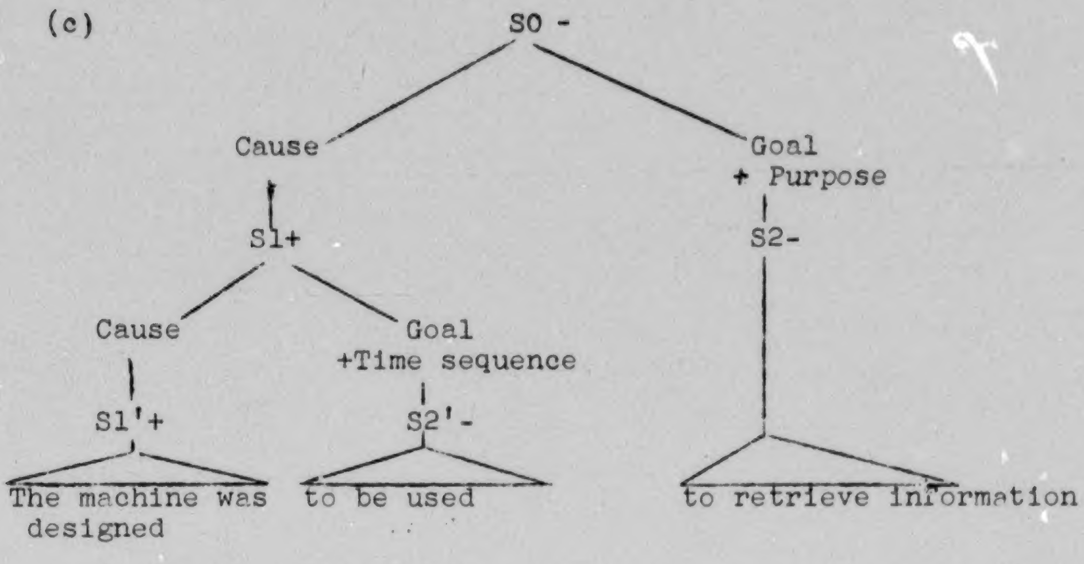
(c) an automatic microfilm searching machine designed to increase searching speed, to edit out extraneous matter, and to provide copies of the desired information (J 1109 : the to-clauses seem to be conjoined symmetrically).

(d) Systems and procedures developed for the search, coding and mechanized processing of bibliographic information on thermophysical properties. (title) Methods used by ... for handling collected bibliographical information on thermophysical properties are described (sentence 1, J 985).

(41)


(a)
S0 -
Cause
Goal + Purpose
S1+
S2-
V
Goal
V
I
O
NP
was designed
the machine
to retrieve
the machine
information
(b)
S0 -
Cause
Goal + Purpose
S1+
S2-
V
I
V
I
O
is used
the machine
to retrieve
the machine
(for) information

(c)


SO -
Cause
Goal
+ Purpose
S1+
S2-
Cause
Goal
+Time sequence
S1'+
S2'-
The machine was designed
to be used
to retrieve information

A comparison between (37) (d) and (e) suggests that one of the functions of Cause-clauses with '*use*' and equivalent predicates is to permit the introduction of more than one Instrument in the same sentence. When these Instruments are related to each other and can be conjoined - as in (37) (d) - the sentences with a *use*-clause are equivalent to the corresponding sentences with instrumental prepositional phrases, as is illustrated in (42). The other type of situation is illustrated in (43) :

(42)

(a) They use a machine to retrieve information with punched-cards.
(b) They retrieve information with a machine and with punched-cards.

(43)

(a) The number of matching terms between the list of request terms and the terms used in indexing a document serves to (is used to) select the documents by computer.
(b) * The number of matching terms and the computer select the documents.
(c) * The number of matching terms and the (a) computer serve (are used) to select the documents.
(d) * They select documents by computer and by the number of matching terms...

A comparison between (37) (f) and (g) suggests that various sentences are convertible into 'instrumental sentences'. When the Object of the Cause-clause is eligible as Instrument of the Goal clause, the result of the conversion can be a 'simple' instrumental sentence, as is shown in (44). Otherwise, but provided the Instrument of the Goal clause is relatable to the Object of the Cause-clause, the sentence can be converted into a sentence with 'use'; this is shown in (45) and in the attested example of (46):

(44)

(a) By throwing at stone (at it), he broke the window.
(b) He broke the window with a stone.
(c) He used a stone to break the window.

(45)

(a) He climbed the tree to watch birds with his field-glasses.
(b) By climbing the tree, he watched birds with his field-glasses.
(c) * He watched birds with the tree and his field-glasses.
(d) He USED the tree to watch birds with his field-glasses.

(46)

(a) By noting the number of matching terms between this extended list of request terms and the terms used in indexing a document (= 0 of 'noting'), and with due regard for their degree of association (=0 of "regard"; compare "considering", etc.), documents are selected by the computer (=I) (J 942).
(b) They USE the number of matching terms and their degree of association to select documents by computer.

Attested examples of negative Cause-clauses are given below in (47). Note that in (47) (b), the by- and the without phrase are conjoinable as Instruments. The advantage, however, of analyzing the without-phrase as a Cause-clause is that such an analysis captures the similarity between this without-phrase and the "even though" clause in (a) :

(47)

(a) (a system) which (=I) can find documents related to a request even though they may not be indexed by the exact terms of the request (=C= without their being... : J 942).

(b) the card selection can be done by sight (=I) without the use of needles or other mechanical selection apparatus (= C = without using...).

3.5.4. The instrumental role of 'system' and related words.

A striking feature of the corpus under investigation is the part played by words like 'system' in allowing for the expression of conceptually complex instrumental relationships. In order to throw some light on the question, I shall posit that the sentence types given below in (48), exemplified in (49), and symbolized more abstractly by tree diagrams in (50) represent the main types of Instrumental relationships which 'system' and related words can contract. In the formulas of (48) and in the trees of (50), the function of the NP with 'system' is represented in main clauses even though the word 'system' or related words occur with relative clauses or relatable constructions in some corresponding examples of (49). Note that in (48) and (49) 'system' is or can be the grammatical subject in all the examples, except in (f) and (g) where such a grammatical function is ruled out for 'system' as Instrument. (48) and (49) (a) represent a sentence type in which it seems that 'system' enters into an Instrumental relationship with a (let us say) 'broader' Instrument than itself, for instance 'theory'. In (48) and (49) (c), on the contrary, 'system' seems to contract a relationship with a 'lesser' Instrument.

(48)

(a) system (= I) + is BASED on + theory (= I).
(b) system (= I) + is USED + TO + V (or : FOR Ving).
(c) system (= I) + USES + technique (or machine, etc.= I).
(d) system (= I) + is BASED on (DEPENDS on) + Ving.
(e) system (= I) + non-instrumental Verb ± I.
(f) Verb (not accepting 'system' as subject) + system (= I?).
(g) Verb (not accepting 'system' as subject) + system (= I?).
+ TO + V (or : FOR Ving).
(h) =(g) but with Verb accepting 'system' as subject.

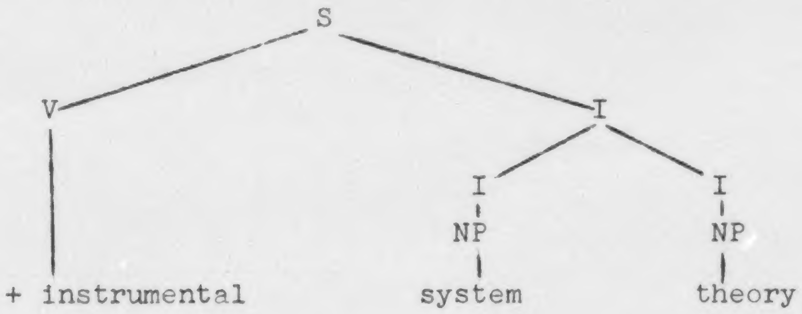
[though perhaps NOT relatable words like 'method' and 'technique' !]

(49)

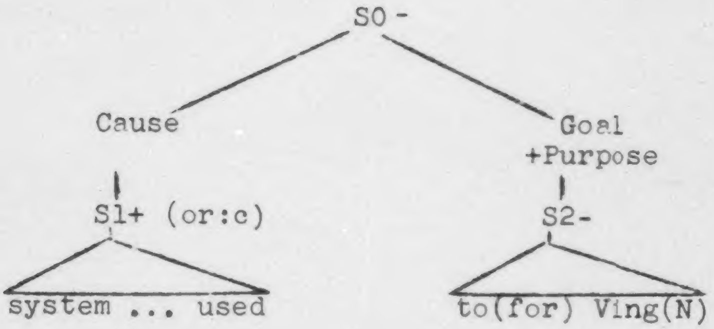
(a) he criticizes six theories upon which experimental retrieval systems have been based (J 54).
(b) Methods used (by ...) for handling collected bibliographical information ... (J 985).
(c) The system described employs three established techniques (J 35).
(d) Most mechanized information retrieval systems depend upon extracting information from documents...(J 321).
(e) This system handles large numbers of chemical compounds and polymers by their structural and compositional features (J 275).
(f) It should be possible to set up, in the near future, a procedure (= system) whereby one can either subscribe to scientific journals on a yearly basis or purchase single articles at a unit price (J 629).
(f') * The procedure can either subscribe... or purchase...
(g) a technique (= system) for literature indexing and searching whereby the notion of relevance is developed quantitatively... (J 640).
(g') * the technique develops the notion of relevance quantitatively...
(g'') ?By (means of) this technique the notion of relevance is developed quantitatively for literature indexing and searching .
(h) a method for arranging and finding documents by assigning to each what is basically a two-faceted, decimal/alphabetic classification designation (J 60).

(50)

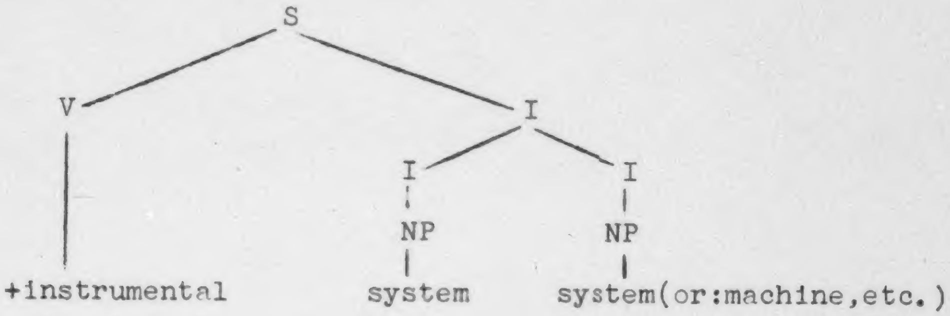
(a)



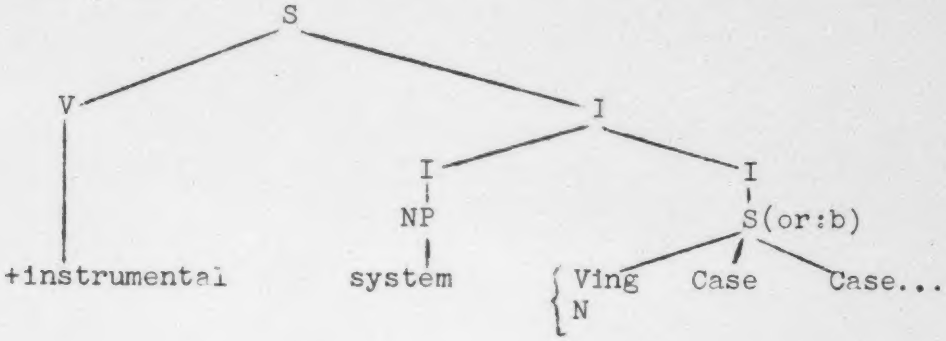
(b)


S0 -
Cause
Goal
+Purpose
S1+ (or:c)
S2-
system ... used
to(for) Ving(N)

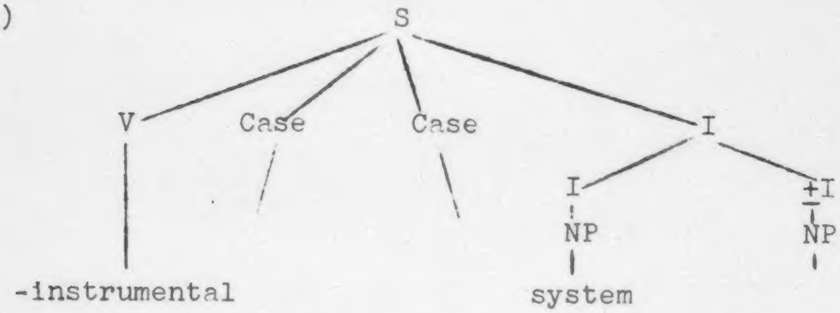
(c)


S
V
I
I
I
NP
NP
+instrumental
system
system(or:machine,etc.)

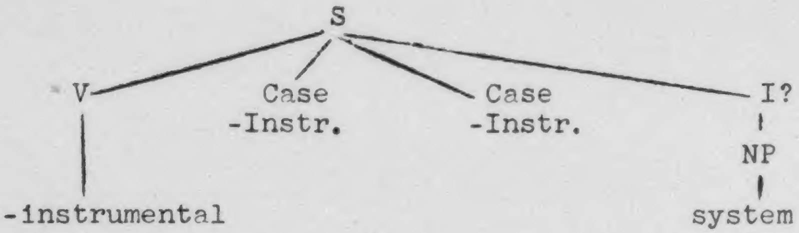
(d)


S
V
I
I
I
NP
S(or:b)
+instrumental
system
Ving
N
Case
Case...

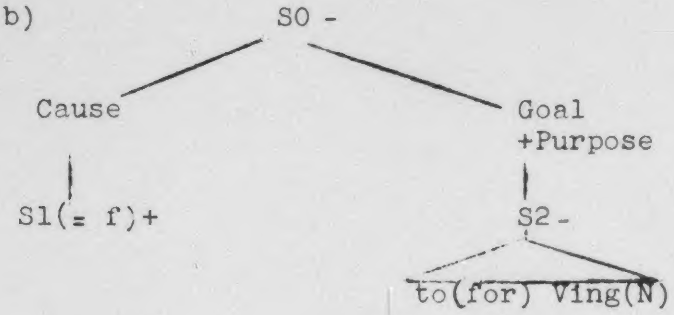
(e)


S
V
Case
Case
I
I
+I
NP
NP
-instrumental
system

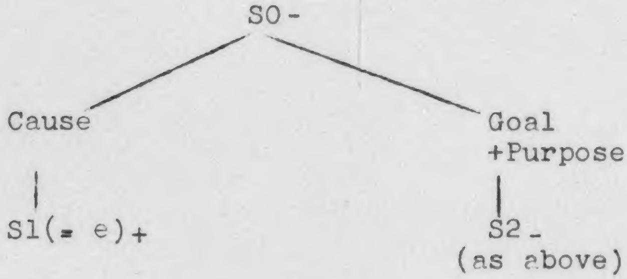
(f)


S
V
Case
-Instr.
Case
-Instr.
I?
NP
system
-instrumental

(g) (cp. b)


SO -
Cause
Goal
+Purpose
S1(= f)+
S2 -
to(for) Ving(N)

(h)

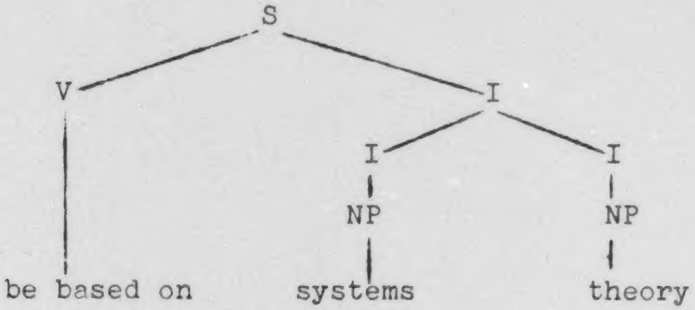

SO -
Cause
Goal
+Purpose
S1(= e)+
S2 -
(as above)

In the rest of this section, I shall present more detailed analyses which I propose for the sentences of (49). In addition, I shall give some nominal constructions which can be paraphrased after the model of these sentences and which, on this basis, can be assumed to have a deep structure similar or relatable to the sentences in question. In the examples, the irrelevant material is given between brackets, and the relative clauses are treated as main clauses, as I shall not discuss the problem of how to represent relative clauses. For some of the illustrative sentences, I have found no corresponding nominal construction.

(51)

(a) Illustrative sentence : (he criticizes six) theories upon which (experimental retrieval) systems have been based (J 54).

(b) Proposed analysis :

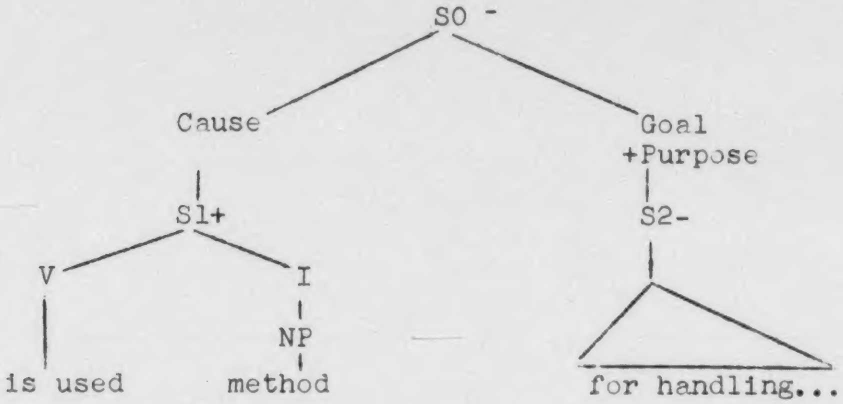

S
V
I
I
I
NP
NP
be based on
systems
theory

(c) Corresponding nominal construction : (retrieval) system theory (J 1044).

(52)

(a) Illustrative sentence : Methods used (by...) for handling collected bibliographical information ... (J 985).

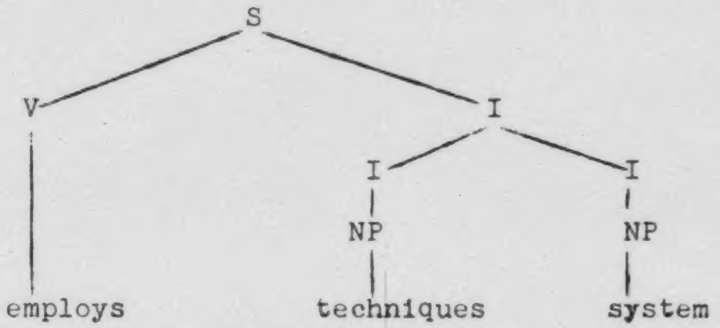
(b) Proposed analysis :


S0 -
Cause
Goal
+Purpose
S1+
S2-
V
I
NP
is used
method
for handling...

(c) Corresponding nominal constructions:
-information retrieval systems (J 321, etc.).
-a scheme for classification and coding of information (for machine retrieval) (J 580).

(53)

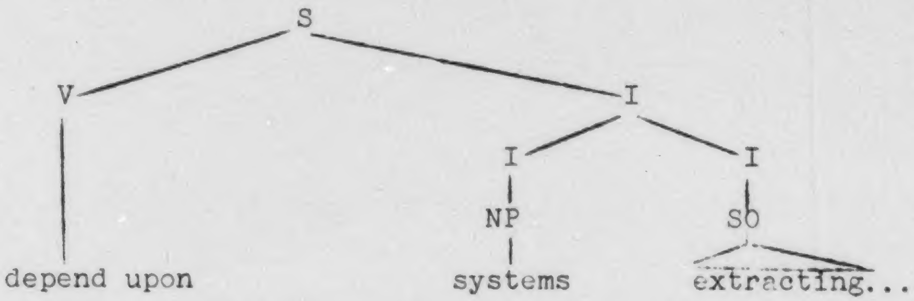
(a) Illustrative sentence : the system (described) employs (three established) techniques (J 35).
(b) Compare : machine based systems (J 471)
(c) Proposed analysis :



(d) Corresponding nominal constructions :
- the punched card system (for indexing...) (J 830).
- A system of information systems (J 146).

(54)

(a) Illustrative sentence : (Most mechanized information retrieval) systems depend upon extracting information from documents, (processing such information in some manner, and finally placing this information in a file so that the information can be retrieved by machine) (J 321).
(b) Compare :
- (as long as searching) devices are based on the use of words (to describe documents) (J 804).
- the system operates by feeding selected clue words into a computer which... (J 639).
(c) Proposed analysis :



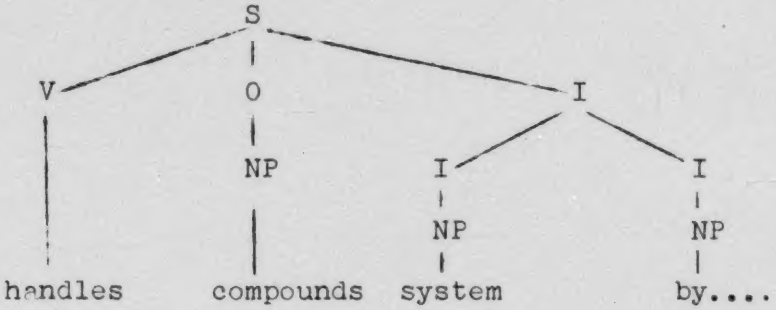
(d) Corresponding nominal construction : NONE.

(55)

(a) Illustrative sentence : This system handles large numbers of chemical compounds and polymers by their structural and compositional features rather than by their names (J 275).

(b) Compare : the (Peek-a-boo) system which achieves random access by means of superimposable cards (J 1104).

(c) Proposed analysis :


S
V
O
I
NP
I
I
NP
NP
handles
compounds
system
by....

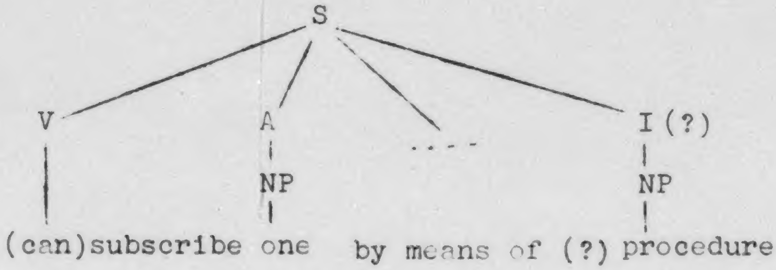
(d) Corresponding nominal construction : NONE.

(56)

(a) Illustrative sentence : (It should be possible to set up, in the near future) a procedure whereby one can either subscribe to scientific journals on a yearly basis ... (J 629).

(b) Compare : (Describes) the methods (developed at the Chemical Abstracts service) by which organic chemical data put on magnetic tape in notation form can be searched mechanically for specific, predetermined structural features (J 274).

(c) Proposed analysis :

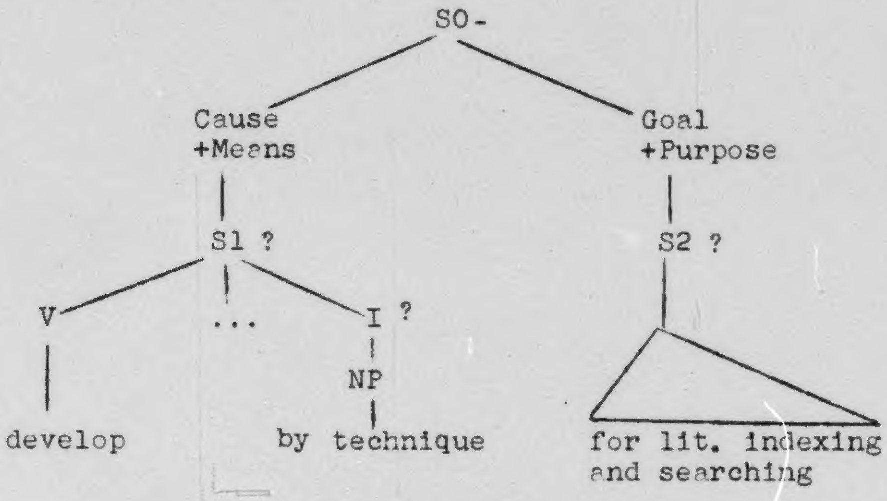

S
V
A
....
I (?)
NP
NP
(can)subscribe
one
by means of (?)
procedure

(d) Corresponding nominal construction : NONE.

(57)

(a) **Illustrative sentence** : a technique for literature indexing and searching whereby the notion of relevance is developed quantitatively... (J 640).

(b) Proposed analysis :

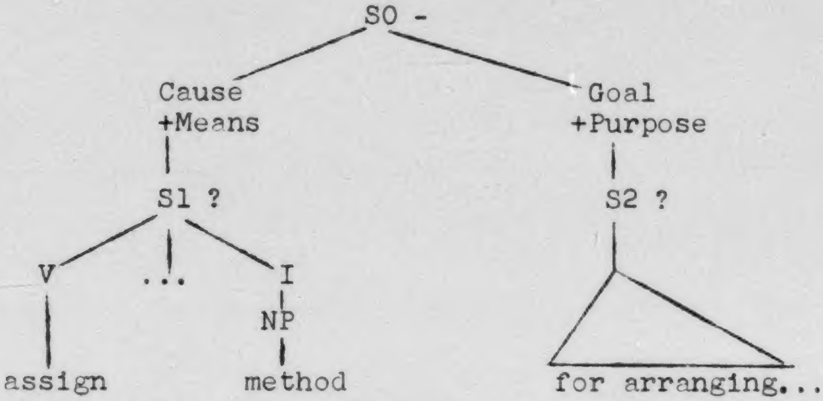

SO-
Cause +Means
Goal +Purpose
S1 ?
S2 ?
V
...
I ?
NP
develop
by technique
for lit. indexing and searching

(d) Corresponding nominal construction : NONE.

(58)

(a) Illustrative sentence : a method for arranging and finding documents by assigning to each what is basically a two-faceted, decimal alphabetic classification designation (J 60).

(b) Proposed analysis :


SO -
Cause +Means
Goal +Purpose
S1 ?
S2 ?
V
...
I
NP
assign
method
for arranging...

(d) Corresponding nominal construction : NONE.

Where a sentential paraphrase exists, the nominal constructions could be analyzed in terms of the corresponding sentences. More precisely, they could be analyzed in terms of sentences with an abstract Instrumental verb which has no surface realization. For instance, "information retrieval system" would be analyzed as "system which Vinstrumental TO retrieve". In this fashion, the nominal constructions in question would be treated as instances of recoverable deletion.

Lastly, in order to cut down the number of sentence types just presented, one may be tempted to do the following :

(i) type (f), namely "a procedure whereby..." could be reduced to type (d); indeed, "a procedure whereby..." and the like can be paraphrased as "a procedure (which) is BASED on ..." (cp. "systems DEPEND upon Ving"). This analysis could also be adopted for the by-clauses of types (g) and (h).

(ii) The purpose-clauses in these sentence types could similarly be reduced to type (b); thus "a method for..." can be paraphrased as "a method (which) is USED for...", as has just been suggested for "retrieval system".

The last illustrative example, for instance, which is repeated as (59) (a), could then be analyzed as in (59) (b), or as a corresponding relative-clause structure (59) (c) :

(59)

(a) A method for arranging and finding documents by assigning to each... a ... classification designation.

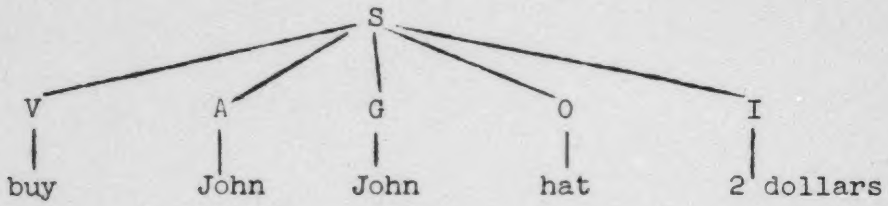
(b) A method is used for arranging and finding documents. The method (it) operates (works) by assigning to each... a... classification designation. (is based on).

(c) A method which is used for ... and operates by ... (is based on).

3.5.5. The locative role of 'system' and related words.

Fillmore (1969 a) allows for the possibility of representing a single surface constituent by two or more case nodes. Thus, in "*John* bought a hat for two dollars" "*John*" would be analyzed as both Goal and Agent :

(60)



The Goal-node in such a sentence usually has no surface realization, and Fillmore (1970 b) proposes to delete it transformationally. Note, however, that this is only *usually* so : a salesman, for instance, can say "I shall buy it *for myself*" (rather than for this firm : B. Mohan, personal communication).

As far as I can see, the most important criterion for setting up multiple case representations is the occurrence of certain prepositional phrases and the use of certain prepositions associated with a given item (e.g. "FOR myself" in the above example). It is clear that the use of prepositions is occasionally non-critical. For instance, *by*-phrases in passive sentences neutralize Agent and Instrument : "done by a machine/by people". Also consider the following attested examples : "the Unit Card System *for* indexing" (J 757), "the unit card system *in* the indexing of ..." (J 758), "the revised unit card system *of* indexing" (J 758). Here, however, I wish to present what I believe to be clear evidence for a Locative analysis of words like '*system*' and '*machine*' in sentences or cognate constructions in which they can also be analyzed as Instruments. The evidence I wish to present is based on the use of certain prepositions. Consider the following examples, in which clearly Locative prepositions could be replaced by Instrumental prepositions such as 'by', 'with', or 'by means of' : (except perhaps with 'use', etc.) :

(61)

(a) cards are read on a microfilm viewer (J 779).
(b) Searches are now made on an ... computer (J 356).
(c) Of the two output systems designed, one stores the content of a selected microphotographs temporarily in an electrostatic tube and displays it on a cathode ray tube (J 37).
(d) a system by which most of the index of Chemical Abstracts could be coded mechanically on a computer for later searching on a computer (J 239, whose title reads : ... searching by the Western Reserve University searching selector).
(e) store and search information in a memory system (J 1113).
(f) system of dissemination of new scientific information In which machines are used (J 613).
(g) This system has been in use for about 10 years and has stored in it over 20,000 references (J 404).
(h) With proper manipulation of these associations (entirely within the machine) ... (J 942).

Also note that "The system uses three types of punched-cards" (J 19) has, next to various Instrumental paraphrases, already given, the following Locative paraphrases :

(62)

(a) In the system, they use three types of punched-cards.
(b) Three types of punched-cards are used in the system.

Lastly, let us consider the following examples in (63). Two points can be made about the relationship between 'retrieve' and 'machines' in these sentences. First, a case analysis is necessary to throw light on what I have called asymmetric conjunction : (63) (a), (b), and (c) make up a chain in which (b) is a necessary condition for (c) and (a) a necessary condition for (b). Second, (63) (c) and (d) suggest that 'machines' can contract both a Source and an Instrumental relation with 'retrieve' (on 'load', see Fillmore 1969a, 128).

(63)

(a) load information into the machines (= Goal)
RESULTS IN load the machine (= Object) with information.
(b) information stored in the machines (= Locative).
Cp. : the system has x stored in it (J 404).
(c) retrieve from the machines (= Source). Cp. :
"librarians must not be unprepared to load the machines or to retrieve from them" (J 363).
(d) the machines (= Instrument) ... are only able to retrieve what has been put into them.

To conclude, I think that two consequences can be drawn from the analyses outlined in this section. First, they suggest that Fillmore's proposals for multiple case analyses are essentially correct : I am not acquainted with any other theory than his that would capture the facts about preposition selection presented in this section.

Second, let us remember Fillmore's principle that "only noun phrases representing the same case may be conjoined" (Fillmore 1968a, 22). While I have no attested example, it seems to me that the following example is conceivable :

(64)

They retrieve information IN, WITH, and FROM the computer.

If such a sentence is acceptable and if Fillmore's principle about conjoined NP's is to be preserved, it is necessary to reject Fillmore's proposal to have separate case nodes for co-referential entities (such as 'John' in 60). What seems to be needed instead is a feature system of the kind proposed in my discussion of asymmetric conjunction : a system in which such features as Locative and Instrument can be attached to nodes whose labels are more general than the features, but which capture what the corresponding observable facts have in common.

Among the advantages of such a system I would mention the following. It would serve to explain why, in various situations, there are no clear reasons to select a Locative preposition such as 'in' rather than an Instrumental preposition such as 'by' or 'with' in noun-phrases with 'machine', 'system', and the like. In addition, the proposal just outlined might serve to account for the use of the clearly Locative preposition 'on' with clearly Instrumental verbs such as 'be based on', 'depend on', and 'rely on'.

3.5.6. Anaphoric and cataphoric uses of 'system'.

I wish to end my analyses with a discussion of another remarkable property of NP's with words like '*system*' , namely that of referring to some (let us say provisionally) 'state of affairs' mentioned before or after the occurrence of the word in question, either in the same sentence or in the same text. Note, incidentally, that various other NP's have the same property : for instance, "on these bases" in "*On these bases*, the paper presents a new system..." (J 963). What is particularly remarkable is the anaphoric use of "on this basis", "this system...", "this technique" WITHOUT any previous occurrence of the same word in a given text. (Cp. : "Current status and needs *in the field* as viewed by practising biologists", J 220). In order to try to understand the conditions under which NP's with '*system*' are used to refer forward or backward to something in the same discourse, let us first consider imaginary examples of anaphoric (65) and cataphoric (66) uses of this word. Let A and B stand for two different persons.

(65)

(a) A : You know, John broke the window with his gun.
B : That's a good system.
(b) A : You know, John used his gun to break the window.
B : That's a good system.
(c) A : You know, our machine does all the work.
B : That's a good system.
(d) * A : You know, it rains a lot in Britain.
B : That's a good system.
(e) * A : You know, three months elapsed.
B : That's a good system.
(f) * A : You know, John broke the window.
B : That's a good system.
(g) A : You know, John broke the window to get in.
B : That's a good system.
(h) * A : You know, he presents his show to-morrow.
B : That's a good system.
(i) A : You know, he presents his show to-morrow, because otherwise he would appear as the main suspect.
B : That's a good system.

(66)

Let me tell you about a new system :

(a) John broke the window with his gun.
(b) John used his gun to break the window.
(c) Our machine does all the work.
(d) * It rains a lot in Britain.
(e) * Three months elapsed.
(f) * John broke the window.
(g) John broke the window to get in.
(h) * He presents his show to-morrow.
(i) He presents his show to-morrow, because otherwise he would appear as the main suspect (≡ he presents his show to-morrow in order not to appear as the main suspect ≡ by presenting his show to-morrow he will not appear as the main suspect.)

(65) and (66) suggest that both the anaphoric and the cataphoric uses of an NP with 'system' or the like depend on the presence of what I propose to represent as a pair consisting of a Cause-clause and a Goal (as in b, g, and i), or on the presence of an Instrument in Fillmore's sense, as in (a), (b), and (c). The Instrument needs to be explicitly mentioned, as suggested by the unacceptability of (f). On the other hand, it seems to me that the Cause-Goal relation need not be explicit, and that (f) and (h) are acceptable if some implicit Goal is understood. (cp. g and i).

In (67) and (68), I give attested examples of respectively anaphoric and cataphoric uses of NP's with 'system' or the like in the same sentence; I am not acquainted with any syntactic rule or rules that would account for the ways in which 'system' can be moved away from what it is related to in such sentences. The main items which I assume 'system' or the like to be related to are capitalized :

(67)

(a) The RETRIEVAL described here is a large-scale system and makes use of a large number of separate machines (J 684).
(b) SEARCHING the film is accomplished by the use of two projectors and two photodiode networks, an arrangement said to permit 16 simultaneous searches in ten minutes with a collection of 125,000 references (J 244).

(68)

(a) A description of the system and an outline of the main classes of the Barnard CLASSIFICATION (J 59).
(b) Elements of classification are introduced by such devices as INSERTING AC before all types of aircraft (J 1032).
(c) The system described employs three established techniques : MICROFILMING, PUNCHED-CARDS, and XEROGRAPHY (J 35).

The first two words ("Describes how") could be omitted from the abstract quoted below in (69) without making the occurrence of 'this system' odd or unacceptable. This suggests that anaphoric 'system' in texts has nothing to do with 'manner' ("how") :

(69)

Describes how the research reports of the Chemical Department of the du Pont Company are indexed and stored on punched cards, and the indexed information is retrieved by using an IBM 101 Electronic Statistical Machine. This system handles large numbers of chemical compounds and polymers by their structural and compositional features rather than by their names. (J 275).

The quotations in (70) show that anaphoric 'system' in texts can be an exponent of any case : presumably an Object of 'maintain' in (a), an Instrument in (c), and an Instrument and a Locative or both in (b). The only difference is that the Object with 'system' in (a) is obligatory, whereas the NP's with 'system' in (b) and (c) could be omitted without affecting either grammaticality or meaning. except in subject position (b).

(70)

(a) Scientific documentation -- the operation of bringing the facts elucidated by scientific research from those who produce them to those who can use of them -- is getting out of hand. Yet we still maintain the traditional *system*. (J 97).

(b) Describes a new experimental attempt to develop automatic classifications of chemical concepts and interrelations in the disclosures of the patent literature. *In this system*, the classification system is made from the disclosures in the patent literature, thereby making it possible to search for all of the information in the file of interest to the searcher. The *system* uses three types of punched cards. (J 19).

(c) Using the officially accepted International System of Notation of Organic Compounds of the International Union of Pure and Applied Chemistry, a modified IBM 026 Card Punch with document writing feature and an IBM 866 electric typewriter, it is now possible to assign to each organic compound a single, mathematically unique group of descriptors, and to punch these into a card and retrieve the original cipher in typewritten form at the rate of 600 characters per minute. *By means of this system*, it is also possible to search for any fragment or combination of fragments, either actually or potentially present in the structure. (J 273).

Also about the texts just quoted, let us note that they confirm the hypothesis, according to which anaphoric '*system*' refers to what I analyze as SO--> SCause + SGoal : for instance, '*attempt* (made) (= Cause-S) *to develop* ...'(= Goal-S). In fact, the following examples suggest that one of the important functions of deictic NP's with '*system*' in discourse is precisely that of linking together Cause and Goal sentences or clauses :

(71)

(a) A letter to the editor proposing the following system of communicating research results : The contributor prepares a full account of his research, sparing no detail, which is permanently filed in a central repository... [and] a two-page abridgment, which is published in journal form and numbered for identification, and a conventional abstract, which is reproduced on cards (border-punched preferably). A subscriber may receive the journal and the cards or, if he prefers, just the cards and may order by postcard photocopies or facsimile reproductions of the full papers on deposit. When the papers prove to be exceptionable, the recipients should voluntarily send their suggestions to the authors, who may then issue revisions to supersede their earlier accounts. An editor may select for full publication articles worthy of general attention or those for which the demand exceeds the resources of economic facsimile copying. (J 783).

(a') A letter to the editor proposing a system FOR communicating research results WHEREBY (IN WHICH) the contributor... and WHEREBY (IN WHICH) a subscriber ... and WHEREBY (IN WHICH) the recipient... and WHEREBY (IN WHICH) an editor...

(b) It should be possible to set up, in the neat future, a procedure whereby one can either subscribe to scientific journals on a yearly basis or purchase single articles at a unit price. Such a system would give scientists greater opportunity to select reading material on the basis of subject and would provide greater return for publishers. It would also make the new scanning tools more available by increasing the availability of items discovered in them. (J 629).

(b') It should be possible to set up... a procedure WHEREBY one can either subscribe... IN ORDER TO give scientists greater opportunity to select reading material and to make the new scanning tools more available...

In the texts quoted in (71), we can attempt to convert all the constructions presumably relatable to relative clauses (such as "system of communicating") and relative clauses (such as "system whereby/in which ...") into 'independent' sentences with "system". This can be done on the basis of suggestions put forward at the end of 3.5.4., and of the Locative status of the word "system". Such paraphrases are given in (72), together with clearly unacceptable or dubious paraphrases :

(72)

(a) A letter to the editor proposing a (new ?) system. This system would be USED to communicate research results. The system would be BASED on the preparation by the contributor..., on the possibility for the subscriber to receive ..., on the obligation (?) for the recipient to send..., and on the possibility for an editor to select...

(a') A letter to the editor proposing a (new ?) system. This system would be USED to communicate research results. IN this system...

(a") ? A letter ... proposing a (new ?) system. This system would COMMUNICATE research results. BY (MEANS OF) this system, the contributor prepares...

(a"') xThis system prepares a full account...

(b) It should be possible to set up, in the near future, a (new ?) procedure. The procedure would be BASED on the possibility of subscribing... Such a system would (SERVE TO) GIVE scientists greater opportunity to ...

(b') It should be possible to set up, in the near future, a (new ?) procedure. IN this system (procedure ?), one can subscribe...

(b") ? BY MEANS OF this system one can subscribe...

(b"') xThis system subscribes...

These paraphrases suggest that :

(i) the constructions with 'BASED on' are acceptable;

(ii) the Locative use of 'system' ('IN this system) makes it possible to use co-ordinate sentences instead of complex sentences with 'BASED on';

(iii) 'IN this system' can be used when (presumably) Instrumental uses of 'system' are dubious ('By MEANS OF this system') or ruled out ('* This system subscribes...');

(iv) WHEREBY (cp. IN WHICH) clauses correspond to 'independent' sentences with 'IN this system'.

On the basis of what precedes, I would conclude the following. What I propose to analyze as Cause-S can be realized in discourse as relative clauses with WHEREBY or IN WHICH depending on 'system', as one 'independent' clause with 'BASED on' or the like as main verb and 'system' as subject, or as any number of co-ordinate sentences with an optional locative prepositional phrase such as 'In this system' acting as discourse connective. I am unable to represent satisfactorily the Locative nature of 'IN WHICH' and 'IN this system' on the basis of my proposals about asymmetric conjunction. What I propose to analyze as Goal-S can be realized as a nominal construction ('system of/for communicating'), or as an independent sentence with USE or the like ('serve to', etc.) or an equivalent 'simple' sentence with 'system' as Instrument in Fillmore's sense when the verb tolerates such an Instrument.

Lastly, I wish to mention a difficulty already referred to about surface conjunctions which also arises in texts. The difficulty is that of determining the semantic status of sentences relatable to (cataphoric) 'system'(or the like) because the text contains no mark (such as prepositions) for deciding that the sentences in question are to be analyzed as Cause or Goal. Thus, in the passage quoted below in (73), there is an obvious cataphoric relation between "three ... techniques", and "microfilming, punched-cards, and xerography" on the one hand, and the sentences that follow on the other. It is also clear from these sentences that time sequence is involved in the enumeration "microfilming, punched-cards, and xerography", and in the corresponding sentences that follow. But I am unable to identify clues that would make it possible to analyze the text in terms of the Cause-Goal relation proposed in this thesis. The word and sentence order, and the "then" in the last sentence do not provide clear enough criteria to set up a detailed AND motivated analysis of the passage quoted below:

(73)

> The system described employs three established techniques : microfilming, punched-cards, and xerography. Documents to be held on file are microfilmed. Each individual picture is cut off the reel of microfilm and mounted over a special aperture cut in a standard eighty-column punched-card. Data identifying the microfilm are punched in columns available on the card. When the document is to be reproduced, the appropriate card is selected either manually or mechanically from the file of cards and placed in a special projector mounted on a xerographic printer. The required number of full-size documents is then printed automatically at a speed of twenty feet a minute. (J35).

Note, however, that the second sentence ("Documents to be held on file are microfilmed") could be introduced by 'In this system'. Note furthermore that (73) could be paraphrased as in (74) :

(74)

> Describes a system which employs three techniques (...) (and) WHEREBY (IN WHICH) documents to be held on file are microfilmed, WHEREBY (IN WHICH) each individual picture is cut off...

APPENDIX 1.

MAIN HEADINGS AND DEFINITIONS OF A LIST OF DESCRIPTORS FOR THE FIELD OF SCIENTIFIC AND TECHNICAL INFORMATION (x).

Groupe 1 : L'INFORMATION SCIENTIFIQUE ET TECHNIQUE : GENERALITES.

Définitions de l'IST ; son objet, ses buts, sa place dans l'activité nationale, dans l'économie, etc... Ses rapports avec la science et l'industrie.
Histoire de l'IST ; son développement récent, la "crise" actuelle de l'IST ; considérations sur l'avenir de l'IST.

Groupe 2 : ORGANISATION DE LA PROFESSION.

Considérations générales sur la ou les professions opérant dans le domaine de l'IST (bibliothécaires, documentalistes, traducteurs, analystes, etc...) ; rôle, développement, réformes souhaitables, etc...
Description de l'organisation professionnelle dans tel ou tel cadre concret : formation, recrutement, enseignements spécialisés, niveaux académiques, salaires, etc... ; associations professionnelles (nationales, internationales).

Groupe 3 : LA SCIENCE DE L'IST.

Etudes théoriques sur les méthodes qui font de l'IST un domaine scientifique ou technique particulier ; l'IST considérée comme une science (la "science de l'information"); les matières qui la constituent.
Doctrines, théories, écoles de pensée, sur la manière de formuler ou de résoudre les problèmes intellectuels de l'IST (notamment ceux qui font l'objet des groupes 12 à 19) ; les modèles correspondants.

Groupe 4 : SCIENCES ANNEXES.

Les sciences auxquelles l'IST fait appel (mathématiques, cybernétique, sémiologie, etc.) ; les concepts ou méthodes qui leur sont propres, considérés dans leur application à l'IST.

(x) All the footnotes have been left out in the French definitions given in this appendix, which are quoted from N. Gardin and F. Lévy (1967).

Groupe 5 : ORGANISATION GENERALE DE L'IST.

Ensemble des organismes et institutions qui forment l'appareil général de l'IST, dans un ou plusieurs pays, ou un plusieurs domaines d'application ; sous-ensembles particuliers, différemment caractérisés (par leur type d'activité, par leur domaine linguistique, par leur statut juridique, etc.); centres nationaux ou internationaux considérés dans leurs rapports avec les organismes dont ils dirigent ou coordonnent les activités ; coopération inter-centres, ses modalités.
Dispositions politiques et juridiques déterminant la structure et le fonctionnement des réseaux d'information.

Groupe 6 : ORGANISMES D'IST.

Organismes à vocation plus ou moins large dans le domaine de l'IST (archives, services d'analyse, centres de traduction, etc.), étudiés individuellement - structure, fonctionnement, coûts, budgets, etc. - ou par types : rôles, modèles, évolution, notamment en rapport avec la mécanisation (ex. : "la bibliothèque en l'an 2000", etc.).

Groupe 7 : FONCTIONNEMENT DE L'IST.

Circulation de l'IST, des "producteurs" (auteurs, éditeurs) aux "consommateurs" (usagers) en passant par les "transformateurs" (analystes, etc.) ; appréciations sur le fonctionnement des réseaux d'information considérés au groupe 5 (i.e. leur valeur dynamique, et non plus seulement leur description statique).
Comportements, habitudes, besoins, désirs des usagers quant aux formes et quant à l'utilisation de l'IST.
Etudes économiques sur le coût de l'IST, considérée comme un service public ; sa part dans le budget national.

Groupe 8 : SOURCES D'INFORMATION.

Les différentes catégories de documents primaires, selon leur forme matérielle (textes, cartes, objets, etc.), les modalités de leurs publications (articles, actes de congrès, mélanges, etc.), etc. : inventaires, évaluations, coûts, dispositions légales, etc...
Les différentes catégories de documents secondaires (ou tertiaires, etc.) - index, bibliographies, résumés, exposés de synthèse, etc. - indépendemment des organismes chargés de les produire (groupe 6) et des méthodes suivies pour les élaborer (groupes 12 à 17) : inventaires, évaluations, coûts ; dispositions légales, etc.

Groupe 9 : POLYGRAPHIE ET REPROGRAPHIE.

Procédés et catégories d'équipements utilisés pour la reproduction de documents (impression, copie), y compris la micro-reprographie (miniaturisation, agrandissements), indépendemment des organismes qui les utilisent (cf. groupe 6), ou des évaluations d'usagers dont ils font l'object (cf. groupe 7) ; leurs coûts.
Problèmes juridiques posés par l'emploi de ces techniques.

Groupe 10 : TRAITEMENT DE L'INFORMATION : GENERALITES.

Ensemble des opérations dont les documents ou informations scientifiques font l'objet, depuis leur collecte (groupe 11) jusqu'à leur dissémination (groupe 22), en passant par les phases intermédiaires de l'analyse (groupes 12 à 19) et de la recherche documentaires (groupe 21) : vues synthétiques sur la chaîne de traitement, modèles généraux, systèmes globaux.
La mécanisation des chaînes de traitement, lorsque les quatre phases ci-dessus sont visées : collecte, analyse (sous quelque variante que ce soit : cf. groupes 12 à 19), exploitation et dissémination ; sinon, cf. les groupes correspondants à chacune de ces phases.

Groupe 11 : COLLECTE DES INFORMATIONS.

L'acquisition des documents ou des informations, dans les services de stockage (bibliothèques, archives) ou d'analyse (centres de documentation) : problèmes, méthodes, procédés de gestion (mécaniques ou autres).

Groupe 12 : ANALYSE DOCUMENTAIRE : GENERALITES.

Ensemble des transformations que peuvent subir les documents ou informations scientifiques, du point de vue de leur signalement (groupe 13) et/ou de leur contenu (groupe 14 à 19), entre le moment de leur collecte (groupe 11) et celui de leur mise en mémoire, sous quelque forme que ce soit (groupe 19) : vues générales sur plusieurs de ces transformations, études synthétiques sur la chaîne d'analyse.
Mécanisation de cette chaîne, lorsque plusieurs types d'analyse sont considérés; sinon, cf. les groupes correspondants à chacun de ces types.

Groupe 13 : CATALOGAGE.

Règles ou pratiques concernant la rédaction des titres ou le signalement des documents pris en compte dans un service d'IST.

Groupe 14 : CONDENSATION : RESUMES.

Au sens large, toute paraphrase d'un texte scientifique sous forme d'un texte plus court, rédigé dans une langue naturelle quelconque (résumés indicatifs ou informatifs, comptes-rendus critiques ou neutres, etc.) : règles, pratiques, méthodes, mécanisation éventuelle.

Groupe 15 : SYNTHESE(S).

Rédaction d'un document secondaire se rapportant à une question ou à un domaine scientifique donné, à partir de plusieurs documents primaires (exposés de synthèse, "states-of-the-art", "trend reports", etc.) : principes et méthodes.

Groupe 16 : CLASSIFICATION ET INDEXATION.

Caractérisation ou représentation d'un document (forme et/ou contenu) au moyen de termes (mots-vedette, descripteurs, termes d'indexation, etc.) tirés d'un langage documentaire quelconque : classification, liste alphabétique de descripteurs, thesaurus, etc. ; principes et méthodes.
Etudes sur des langages documentaires particuliers.
Mécanisation de l'indexation, i.e. de la conversion du langage naturel au langage documentaire, dans quelque domaine et pour quelque langue que ce soit.
Mécanisation de la classification, i.e. de la genèse des langages documentaires utilisés pour l'indexation.

Groupe 17 : EXTRACTION, TABULATION : INDEX.

Observation des occurrences de certains mots, groupes de mots ou phrases, dans les documents (langage naturel), ou de descripteurs dans les représentations indexées de ces documents (langage documentaire), en vue de l'établissement d'extraits, d'index (tables d'occurrences, par ordre alphabétique), ou de concordances (id., avec indication du contexte, plus ou moins étendu) ; méthodes d'observation : 1) par consultation de tables "positives" (listes des mots ou groupes de mots à retenir comme constituants d'un extrait ou comme entrées d'un index) ; 2) par consultation de tables "négatives" (listes des mots ou groupes de mots à exclure des extraits ou index) ; 3) par des critères statistiques (fréquences, co-occurrences, etc.).
Observation de chaînes de citation, rétrospectives ou prospectives : les "index de citation".
La mécanisation de ces processus.

Groupe 18 : TRADUCTION.

Conversion d'une langue naturelle en une autre (et non en un langage documentaire ; cf. groupe 16, ni la conversion de l'une ou de l'autre en un système de notation symbolique, cf. groupe 19) : principes et méthodes, dans le contexte de l'IST.
La traduction automatique, appliquée à l'IST.

Groupe 19 : CODIFICATION.

Conversion de termes du langage naturel ou documentaire vers un système de notation quelconque, pour faciliter l'enregistrement et l'exploitation des informations représentées par ces termes ; la conception de tels systèmes.

Groupe 20 : ENREGISTREMENT ET STOCKAGE.

Procédures et équipements spéciaux (par catégorie) utilisés pour la mise en mémoire des documents et/ou des produits de l'analyse dont ils ont fait l'objet (groupes 12 à 19) ; méthodes dites "conventionnelles", méthodes mécaniques.

Groupe 21 : RECHERCHE DOCUMENTAIRE.

Procédures de la recherche rétrospective (tris, compilations, sélections, etc.), envisagées soit dans l'abstrait indépendamment des moyens matériels mis en oeuvre, soit dans le cadre d'une organisation concrète disposant de moyens "conventionnnels" et/ou "mécaniques" : modèles, systèmes de recherche rétrospective, stratégie de recherche, évaluation des résultats, études comparées (ex. : systèmes conventionnels vs. mécaniques), etc.

Groupe 22 : DISSEMINATION.

Procédures visant à une dissémination systématique des produits obtenus à la sortie d'un système de traitement de l'IST : abonnements, profils d'intérêt, dissémination sélective, etc.

Groupe 23 : MATERIEL.

Equipements immobiliers ou mobiliers utilisés pour les organismes d'IST : bâtiments particuliers, leurs aménagements ; le matériel spécial dont ils sont dotés, pour le stockage et la consultation des documents.

Ensembles mécaniques à fonctions multiples utilisés pour le traitement de l'IST (entrée, stockage, sélection, impression), par catégories (ex. : sélecteurs manuels, équipements mécanographiques, sélecteurs photoélectriques, calculateurs électroniques, etc.) ; codes et langages symboliques correspondants ; composants particuliers. Matériel de bureau affecté à des fonctions spéciales, dans le traitement de l'IST - reprographie et polygraphie mises à part : cf. groupe 9.

Groupe 24 : TERMINOLOGIE.

Travaux de lexicographie entrepris dans une ou plusieurs langues naturelles, et pour quelque domaine que ce soit, à des fins documentaires ou non : glossaires, lexiques, dictionnaires, thesaurus, listes de "mots vides" (i.e. les dictionnaires d'exclusion utilisés pour la fabrication de certains index KWIC ou autres), etc.

Groupe 25 : STANDARDISATION.

Recommandations, projets, accords visant à normaliser tel ou tel élément, démarche, instrument, etc., dans les travaux concernant l'IST (ex. : alphabets, codes, abréviations, etc.). Les objets visés par la standardisation peuvent être désignés par des descripteurs tirés des groupes appropriés (ex. : groupes 8, sources ; 14, résumés ; 16, langages documentaires, etc.), ou récapitulés directement dans ce groupe ; un troisième parti également acceptable aurait été de renoncer à ce groupe, et de citer la notion de standardisation à propos de chacun des objets auxquels on l'applique.

APPENDIX 2.

ENGLISH TRANSLATION OF THE MAIN HEADINGS OF THE GARDIN-LEVY CONCORDANCE.

1. Scientific and technical information : generalities.
2. Professional problems.
3. Information science.
4. Related sciences.
5. General organization of scientific and technical information.
6. Scientific and technical information institutions.
7. Functioning of scientific and technical information networks.
8. Sources of information.
9. Techniques of reproduction.
10. Information handling : generalities.
11. Collection of information.
12. Documentary analysis : generalities.
13. Cataloguing.
14. Abstracting.
15. Synthesis.
16. Classification and indexing.
17. Extracting, tabulation and index production.
18. Translating.
19. Coding.
20. Storing.
21. Searching.
22. Dissemination.
23. Machines and equipment.
24. Terminology.
25. Standards.

APPENDIX 3.

THE FIRST 50 ABSTRACTS OF JANASKE 1962 : EDITED VERSION.

1. THE JAPANx INFORMATIONx CENTERx OF SCIENCEx AND TECHNOLOGYx AND ITS ACTIVITIES . A GENERAL DESCRIPTION OF THE JAPANx INFORMATIONx CENTERx OF SCIENCEx AND TECHNOLOGYx WHICH WAS ESTABLISHED FOR THE PURPOSE OF CONTRIBUTING TO THE DEVELOPMENT OF SCIENCE AND TECHNOLOGY BY COLLECTING , PROCESSING , STORING , AND RETRIEVING SCIENTIFIC INFORMATION . AT THE TIME OF THIS REPORT , THE CENTER WAS PLANNING TO CHANGE OVER TO A MECHANIZED STORAGE AND RETRIEVAL SYSTEM SIMILAR TO THAT USED BY THE U.S.x PATENTx OFFICEx . SERVICES AVAILABLE FROM THE CENTER AND THE CHARGES FOR EACH ARE LISTED .

2. REPORT ON A STUDY OF SCIENTIFIC COMMUNICATION FOR THE NATIONALx SCIENCEx FOUNDATIONx . THIS REVIEWS THE INITIAL REASONING AND THINKING BEHIND THE DESIGN AND CONSTRUCTION OF A PROJECT SUPPORTED BY THE NATIONALx SCIENCEx FOUNDATIONx , CARRIED OUT BY THE OPERATIONSx RESEARCHx GROUPx AT THE CASEx INSTITUTEx OF TECHNOLOGYx TO DETERMINE WAYS TO AFFECT THE BEHAVIOR OF SCIENTIFIC INSTITUTIONS THAT ARE RESPONSIBLE FOR THE DISSEMINATION OF RECORDED INFORMATION IN ORDER TO ACHIEVE A NET IMPROVEMENT IN SCIENTIFIC PRODUCTIVITY .

3. PROBLEMS IN COMMUNICATING RUSSIANx SCIENCE . AN OUTLINE OF THE NATIONALx INSTITUTEx OF HEALTHx RUSSIANx SCIENTIFIC TRANSLATION PROGRAM , WITH A DISCUSSION OF THE PROBLEMS OF SELECTION , FORM , DISTRIBUTION , ACCEPTABILITY , AND TRANSLATION RIGHTS .

4. SEARCHING MEDICINAL CHEMICAL LITERATURE . xTHREE REPRESENTATIVE PROBLEMS OF A MANUFACTURER OF FINE CHEMICALS IN SEARCHING FOR INFORMATION IN THE MEDICAL AND CHEMICAL LITERATURE : SEARCHING THE BOTANICAL DRUG LITERATURE FOR FOLK REMEDIES ; INTERPRETING AND DETERMINING THE CONTENT OF FOREIGN PRESCRIPTIONS ; AND TRACING AND IDENTIFYING THE MERCKx REFERENCES .

5. THE FEDERALx GOVERNMENTx AND U.S.x SCIENTIFIC INFORMATION . IN ADDITION TO PRESENTING A GENERAL REVIEW OF THE SCOPE OF THE FEDERALx GOVERNMENTx 'S ROLE IN RESEARCH AND DEVELOPMENT , AND A REVIEW OF THE CHARACTER OF THE FEDERALx GOVERNMENTx 'S SCIENTIFIC INFORMATION ACTIVITIES , THIS ARTICLE PRESENTS A REVIEW OF THE xSIX-POINT PROGRAM WHICH HAS BEEN DEVELOPED BY THE NATIONALx SCIENCEx FOUNDATIONx FOR IMPROVING THE DISSEMINATION OF SCIENTIFIC INFORMATION , PARTICULARLY AMONG U.S.x SCIENTISTS AND ENGINEERS . THE AUTHOR CONCLUDES THAT THE DISSEMINATION OF SCIENTIFIC INFORMATION MUST BE RECOGNIZED AS AN INTEGRAL PART OF RESEARCH AND DEVELOPMENT .

6. UNITEDx STATESx SCIENTIFIC AND TECHNICAL INFORMATION SERVICES . THIS DISCUSSION OF UNITEDx STATESx SCIENTIFIC AND TECHNICAL INFORMATION SERVICES IS DIVIDED INTO THE FOLLOWING PARTS : THE PRESENT SITUATION IN THE UNITEDx STATESx ; SOME OF THE REASONS BEHIND THE CURRENT PROBLEMS ; THE PRINCIPAL SCIENTIFIC AND TECHNICAL INFORMATION ACTIVITIES OF THE FEDERALx GOVERNMENTx ; AND A PROPOSED PROGRAM TO REMEDY THIS COUNTRY 'S SCIENTIFIC AND TECHNICAL INFORMATION ILLS .

7. LIST OF DOCUMENTATION CENTERS IN THE GERMANx DEMOCRATICx REPUBLICx . THE ADDRESS IS GIVEN FOR EACH OF x82 DOCUMENTATION CENTERS . ADDITIONAL INFORMATION CONCERNS AVAILABILITY OF MICROFILM AND PHOTOCOPYING SERVICES OR PHOTOCOPYING SERVICE ONLY , THE SUBJECT OF PRIMARY INTEREST TO THE CENTER , AND COVERAGE PROVIDED OVER PERTINENT SOVIETx PERIODICAL LITERATURE.

8. TRAINING THE SCIENTIFIC INFORMATION OFFICER . POINTS OUT THE DIFFERENCE BETWEEN THE FUNCTION OF A SCIENTIFIC INFORMATION OFFICER AND A LIBRARIAN . A SYLLABUS IS PRESENTED FOR A POST-GRADUATE COURSE OF TRAINING FOR A STUDENT WHO IS ALREADY A SUBJECT SPECIALIST .

9. THE IBM-650x INFORMATION RETRIEVAL SYSTEM . DESCRIBES THE IBM-650x INFORMATION RETRIEVAL SYSTEM WHICH USES THE INVERTED FILE . IN THIS FILE EACH TERM RECORD CONTAINS ALL OF THE DOCUMENT CODES FOR ALL OF THE DOCUMENTS IN WHICH THE TERM APPEARS . THEREBY IT IS ONLY NECESSARY FOR THE MACHINE TO SEARCH THE PERTINENT TERMS IN THE MACHINE 'S MEMORY.

10. STORAGE AND RETRIEVAL OF BIOLOGICAL INFORMATION . A GENERAL DISCUSSION OF THE PRESENT STATE OF BIOLOGICAL LITERATURE , WITH EMPHASIS ON SCIENTIFIC NOMENCLATURE , THE LIFE SPAN OF BIOLOGICAL LITERATURE , AND THE STORAGE AND RETRIEVAL OF BIOLOGICAL SPECIMENS .

11. SOME PROBLEMS AND QUESTIONS OF PATENT DOCUMENTATION IN INDUSTRY . A COMPARISON IS MADE AMONG MAGNETIC DRUMS , MAGNETIC TAPE , MAGNETIC WIRE , FERROMAGNETIC CORES , PUNCHED-CARDS , PUNCHED TAPES , AND PHOTOGRAPHIC TAPES WITH RESPECT TO THEIR ACCESS , DURABILITY , STORAGE AND RETRIEVAL TIME , CAPACITY , AND EFFICIENCY . IT IS CONCLUDED THAT THE MOST ECONOMIC , AS FAR AS COSTS PER INFORMATION UNIT ARE CONCERNED , IS MAGNETIC TAPE . IT ALSO POSSESSES THE GREATEST INFORMATION CAPACITY . xFIVE SUGGESTIONS ARE ADVANCED FOR A PRACTICAL SOLUTION OF PATENT DOCUMENTATION PROBLEMS .

12. TOWARD A PROCEDURE FOR LOGICALLY CATALOGING KNOWLEDGE . SUGGESTS AN APPROACH TO THE CATALOGING OF THE ENTIRE BODY OF WRITTEN KNOWLEDGE BY VIEWING IT AS FINITE SERIES OF CONJOINED PROPOSITIONS WHICH MAY BE ORDERED ACCORDING TO THEIR LOGICAL STRUCTURE . AN APPLICATION OF THIS METHOD TO CATALOGING THEOREMS OF MODERN LOGIC IS SELECTED AS PARTICULARLY APPROPRIATE FOR ILLUSTRATIVE PURPOSES . BINARY-OCTAL DESIGNATIONS ARE ESTABLISHED FOR THEOREMS , SYSTEMS OF LOGIC AND FOR STATEMENTS IN PROPOSITIONAL CALCULUS , DERIVED FROM CERTAIN OF THEIR BASIC CHARACTERISTICS . THE AUTHOR RECOGNIZES THAT NOT ALL STATEMENTS CAN BE EXPRESSED IN AS NEAT A FASHION AS HIS EXAMPLES FROM THE FIELD OF LOGIC . HE FEELS , HOWEVER , THAT AT LEAST SUBSTANTIAL PROPORTION OF THAT WHICH MAY BE WRITTEN IN A NATURAL LANGUAGE CAN BE REDUCED TO A STANDARD FORM THAT WILL DETERMINE THE APPROPRIATE PLACEMENT IN A CATALOG .

13. SEARCHING THE CHEMICAL LITERATURE . THIS IS A REVISED AND ENLARGED EDITION OF ADVANCES* IN CHEMISTRY* SERIES* . BASED ON PAPERS PRESENTED BY THE DIVISION* OF CHEMICAL* LITERATURE* AND THE DIVISION* OF CHEMICAL* EDUCATION* OF THE AMERICAN* CHEMICAL* SOCIETY* AT NATIONAL MEETINGS FROM *1947 TO *1956 . CONCERNED PRIMARILY WITH CHEMICAL INFORMATION STORAGE AND RETRIEVAL , MOST OF THE MATERIAL HAS BROAD APPLICATIONS IN OTHER DISCIPLINES .

14. ROSTER OF CURRENT RESEARCH , DEVELOPMENT , AND TESTING IN DOCUMENTATION AND LIBRARIANSHIP , *1957-1958 . LISTS APPROXIMATELY *80 INDIVIDUALS OR ORGANIZATIONS WORKING IN THE FOLLOWING *7 AREAS : CODING FOR MECHANICAL SEARCHING SYSTEMS ; RETRIEVAL AND REPRODUCTION ; EQUIPMENT FOR INFORMATION STORAGE ; INDEXING , CATALOGING , AND CLASSIFICATION ; TRANSLATION BY MECHANICAL MEANS ; PRODUCTION AND DISSEMINATION OF INFORMATION ;USE OF INFORMATION AND USER REQUIREMENTS ; THEORETICAL STUDIES .

15. ADVANCES IN EDP* AND INFORMATION SYSTEMS . PAPERS IN THIS VOLUME ARE BASED ON MATERIAL ORIGINALLY PRESENTED AT AMAS* 'S *SEVENTH ANNUAL* DATA* PROCESSING* CONFERENCE* , HELD IN MARCH* *1961 . PARTIAL CONTENTS : ADVANCES IN INFORMATION RETRIEVAL AND DATA ACQUISITION ; PROGRESS IN THE DESIGN OF INFORMATION RETRIEVAL SYSTEMS ; IMPROVED INFORMATION STORAGE AND RETRIEVAL SYSTEMS .

16. TECHNICAL COMMUNICATION IN PSYCHOLOGY ; A STATEMENT OF THE PROBLEM . THIS STATEMENT EVOLVED OUT OF THE DELIBERATIONS OF THE BOARD* OF SCIENTIFIC* AFFAIRS* OVER A SPAN OF *TWO YEARS . THE BSA* CONSIDERS THE PROBLEM OF EFFICIENT AND EFFECTIVE COMMUNICATION OF SCIENTIFIC INFORMATION TO BE PERHAPS THE MOST CRITICAL PROBLEM FACED BY SCIENTIFIC PSYCHOLOGY TODAY . THE PRINCIPAL NEEDS OF SCIENTIFIC PSYCHOLOGY FOR COMMUNICATION MAY BE CATEGORIZED INTO *FOUR CLASSES : NEED FOR RAPID COMMUNICATION OF WHAT AND HOW , NEED FOR DIRECT DISCUSSION AND COMPARISON OF IDEAS AND FINDINGS , NEED FOR ADEQUATE AND EFFICIENT ARCHIVAL STORAGE , AND NEED FOR INTEGRATED RETRIEVAL OF INFORMATION . WITH RESPECT TO THE LATTER PSYCHOLOGISTS SHOULD ATTEND IMMEDIATELY TO THE PROBLEM OF ENCYCLOPEDIC

ORGANIZATION OF THEIR KNOWLEDGE AND CODIFICATION OF THE METHODS , MEASURES AND RESULTS OF PSYCHOLOGY SO THAT ADVANTAGES OF THE NEW TECHNIQUES FOR AUTOMATIC STORAGE OR RETRIEVAL OF INFORMATION MAY BE EXPLOITED .

17. RESEARCH STUDY OF CRITERIA AND PROCEDURES FOR EVALUATING SCIENTIFIC INFORMATION RETRIEVAL SYSTEMS . A STUDY OF THE REQUIREMENTS , CRITERIA , AND MEASURES OF PERFORMANCE WHICH MAY BE USED TO EVALUATE AND COMPARE SCIENTIFIC INFORMATION RETRIEVAL SYSTEMS . BASED ON THE RESULTS OF THIS STUDY , RECOMMENDATIONS WERE MADE FOR APPLICATION OF THESE FINDINGS TO EXISTING AND PROPOSED SYSTEMS , AND FOR FURTHER RESEARCH EFFORTS IN THE EVALUATION OF SCIENTIFIC INFORMATION RETRIEVAL SYSTEMS .

18. APPLICATION OF HIGH-SPEED COMPUTERS TO INFORMATION RETRIEVAL . THIS IS A DESCRIPTION OF THE FOLLOWING TYPES OF INFORMATION RETRIEVAL SYSTEMS : STATISTICAL , SYNTACTICAL AND INTERRELATIONAL . IN ADDITION , THE COMPUTER RESEARCH PROGRAM OF THE PATENTx OFFICEx IS DESCRIBED .

19. AUTOMATIC CATEGORIZATION OF CHEMICAL CONCEPTS AND INTERRELATIONSHIPS . DESCRIBES A NEW EXPERIMENTAL ATTEMPT TO DEVELOP AUTOMATIC CLASSIFICATIONS OF CHEMICAL CONCEPTS AND INTERRELATIONS IN THE DISCLOSURES OF THE PATENT LITERATURE . IN THIS SYSTEM , THE CLASSIFICATION SYSTEM IS MADE FROM THE DISCLOSURES IN THE PATENT LITERATURE , THEREBY MAKING IT POSSIBLE TO SEARCH FOR ALL OF THE INFORMATION IN THE FILE OF INTEREST TO THE SEARCHER . THE SYSTEM USES xTHREE TYPES OF PUNCHED-CARDS . ONE OF ITS FEATURES IS THAT ALTHOUGH THE CLASSIFICATION IS VARIABLE , THE DISCLOSURES ARE FIXED .

20. INTERRELATIONSHIPS AS A BASIS FOR INFORMATION RETRIEVAL . THE WRITER FEELS THAT NO LARGE SCALE INFORMATION RETRIEVAL SYSTEM CAN BE A SUCCESS UNLESS IT CAN HANDLE SEARCHING FOR COMPLEX RELATIONSHIPS . HE EXPLAINS SOME SCHEMES FOR CODING RELATIONSHIPS USING SEPARATE RELATIONSHIP ITEMS ; COMPOUNDING ITEMS ; ORDERING ITEMS ; AND INTERFIXING TERMS .

21. PROBLEMS OF PREPARING AN INVERTED FILE . AN INVERTED FILE IS AN ORGANIZING SYSTEM FOR THE STORED INFORMATION IN A MACHINE MEMORY SO THE INFORMATION IS DIVIDED INTO AS MANY SECTIONS AS THERE ARE DIFFERENT CODES REPRESENTING ALL OF THE SUBUNITS OF INFORMATION IN ALL OF THE DOCUMENTS IN THE MEMORY OF THE MACHINE . THE MEMORY ADDRESSES USED TO DESIGNATE THESE SECTIONS IN A PARTICULAR MACHINE SYSTEM ARE USED AS THE CODES FOR THE INFORMATION SUBUNITS . THE ADVANTAGES OF THIS INVERTED SEARCH FILE AS COMPARED TO SOME OTHER SEARCH FILE SYSTEM ARE MANY , INCLUDING LESS TIME FOR MACHINE INTERROGATION OF THE FILE . MANY OF THESE ADVANTAGES WILL BE LOST UNLESS A SYSTEMATIC PROCEDURE IS DEVELOPED FOR PREPARING THE FILE . THE AUTHOR SUGGESTS WAYS OF ATTACKING THE PROBLEMS CONFRONTED IN DEVELOPING SUCH A FILE PREPARATION PROCEDURE .

22. RECENT ADVANCES IN PATENT* OFFICE* SEARCHING : STEROID COMPOUNDS AND ILAS* . A DESCRIPTION OF SEVERAL METHODS OF CODING CHEMICAL COMPOUNDS IN PATENTS FOR THE PILOT PROJECT OF THE U.S.* PATENT* OFFICE* AND THE NATIONAL* BUREAU* OF STANDARDS* . THE CODED INFORMATION IS SEARCHED BY MACHINE TO PROVIDE THE EXAMINER WITH PRIOR ART SEARCH . THE RESULTS ARE GRATIFYING IN THAT IT IS PROVING TO BE POSSIBLE TO REDUCE THE EXAMINER 'S TIME REQUIRED TO COMPLETELY HANDLE A PATENT APPLICATION FROM AN AVERAGE OF *TEN HOURS EACH TO *TWO HOURS OR LESS . IN ADDITION , IT APPEARS THAT THE RESULTS OF THE MACHINE SEARCHES WILL BE MORE ACCURATE THAN HAND SEARCHES .

23. BASIC DIRECTIONS OF WORK AT THE EXPERIMENTAL* LABORATORY* OF MACHINE* TRANSLATION* . THIS IS AN EXPLANATION OF THE PROGRAM OF RESEARCH CARRIED ON AT THE LENINGRAD* UNIVERSITY* EXPERIMENTAL* LABORATORY* OF MACHINE* TRANSLATION* . ONE BASIC PART OF THEIR PROGRAM INVOLVES THE USE OF AN INTERMEDIATE LANGUAGE BETWEEN THE INPUT AND OUTPUT LANGUAGES .

24. THE UNIVERSAL CODE OF SCIENCE AND MACHINE LANGUAGES . THE CREATION OF A UNIVERSAL CODE OF SCIENCE STILL WILL REQUIRE MUCH WORK . *TWO OF THE ELEMENTS NEEDED ALREADY EXIST IN A PARTIALLY DEVELOPED FORM . WORK IS JUST BEGINNING ON THE DEVELOPMENT OF THE *THIRD ELEMENT , MACHINE LANGUAGES .

25. ARCHIVES , LIBRARIES AND DOCUMENTATION CENTERS OF SWITZERLAND* . GUIDE THROUGH SWISS* DOCUMENTATION . AN ANNOTATED INDEX TO *459 OF THE MOST IMPORTANT SWISS* LIBRARIES , ARCHIVES , DOCUMENTATION CENTERS , ETC. , ARRANGED BY GEOGRAPHICAL LOCATION . DESCRIPTIVE DATA INCLUDE HISTORICAL DEVELOPMENT , HOLDINGS , SPECIAL COLLECTIONS , CLASSIFICATION SYSTEMS USED , AND USER INFORMATION . THE ANNOTATIONS ARE WRITTEN IN THE LANGUAGE USED IN THE PERTINENT GEOGRAPHICAL REGION : GERMAN* , FRENCH* , ITALIAN* . ALPHABETICAL INDEXES OF INSTITUTIONS , SUBJECTS , AND PERSONNEL ARE INCLUDED .

26. A *THREE-SYMBOL CODE FOR SEARCHING CHEMICAL STRUCTURES . A DESCRIPTION OF A *THREE-SYMBOL CODE DESIGNED FOR USE AS A DETAILED SEARCH CODE FOR PHARMACEUTICAL CHEMICALS . THIS IS A MODIFICATION OF THE WISELOGLE* CLASSIFICATION SYSTEM . THE CODE AND CARD DESIGN CONSTITUTES A MAJOR CHANGE , SINCE ALL FUNCTIONAL UNITS , AND NOT MERELY THE FILING CATEGORIES , CAN BE PUNCHED , PROVIDING A SEARCH CODE AS WELL AS A FILING ORDER CODE . ALTHOUGH THIS SYSTEM WAS ORIGINALLY DESIGNED TO BE USED WITH EDGE-PUNCHED , HAND-SORTED CARDS THE AUTHOR INDICATES THAT IT CAN BE EASILY MODIFIED FOR CENTER-PUNCHED CARD WHICH WOULD PERMIT MACHINE SORTING .

27. INFORMATION RETRIEVAL : A PRAGMATIC APPROACH . A DESCRIPTION OF THE DEVELOPMENT OF A NEW SUBJECT INDEX FOR THE LIBRARY* AND INFORMATION* SERVICE* , PAINT* DIVISION* , IMPERIAL* CHEMICAL* INDUSTRIES* LIMITED* . THE ARTICLE ALSO INCLUDES A SHORT ACCOUNT OF THE VARIOUS TYPES OF SUBJECT INDEXES USED BY THIS LIBRARY IN THE PAST .

28. ECONOMIC ASPECTS IN THE DISSEMINATION OF CHEMICAL KNOWLEDGE . PROPOSES THE ESTABLISHMENT BY THE AMERICAN* CHEMICAL* SOCIETY* OF A SYSTEM FOR HANDLING INFORMAL LITERATURE , AND A COMPREHENSIVE COPYING SERVICE . THIS INFORMAL LITERATURE WOULD BE PROVIDED IN MANUSCRIPT FORM PREPARED TO SPECIFICATIONS SUCH AS THOSE USED FOR DIVISIONAL REPRINTS AND GENERALLY MEETING THE STANDARDS OF COMPANY REPORTS AND MEMORANDA .

29. SYSTEMS OF SCIENTIFIC AND TECHNICAL INFORMATION SERVICES : LONG RANGE PLANNING . A PROPOSAL FOR THE ESTABLISHMENT OF AN INTERNATIONAL TECHNICAL INFORMATION SYSTEM WHICH WOULD BE BASED ON *THREE MAIN INTERNATIONAL CENTERS : ONE FOR THE AMERICAS* ; ONE FOR EUROPE* , THE NEAR* EAST* AND AFRICA* ; ONE FOR ASIA* AND AUSTRALASIA* . IN ADDITION , THERE WOULD BE A NATIONAL CENTER FOR EACH COUNTRY , AND A CENTER FOR EACH SCIENTIFIC OR TECHNICAL DISCIPLINE . THE PAPER ALSO INCLUDES DISCUSSION OF PROBLEMS WHICH WOULD BE ENCOUNTERED IN THE DEVELOPMENT OF SUCH A SYSTEM .

30. DIRECTORY OF DATA PROCESSING SERVICE CENTERS . LISTS SERVICE BUREAUS IN CANADA* AND THE UNITED* STATES* BY PROVINCE OR STATE , AND BY CITY WITHIN PROVINCE OR STATE .

31. ASLIB* AERO* GROUP* CONFERENCE* . SUMMARY OF SYMPOSIUM ON AERONAUTICAL DOCUMENTATION IN THE SEVERAL NATO* COUNTRIES , INCLUDING DESCRIPTION OF EFFORTS IN CANADA* , FRANCE* , HOLLAND* , FEDERAL REPUBLIC* OF GERMANY* , U.S.A.* , AND ITALY* .

32. THE ROLE OF LARGE MEMORIES IN SCIENTIFIC COMMUNICATION . LARGE MEMORIES PROVIDE AUTOMATIC REFERENCE TO *MILLIONS OF WORDS OF MACHINE-READABLE CODED INFORMATION OR TO *MILLIONS OF IMAGES OF DOCUMENT PAGES . HIGHER DENSITIES OF STORAGE WILL MAKE POSSIBLE LOW-COST MEMORIES OF *BILLIONS OF WORDS WITH ACCESS TO ANY PART IN A FEW SECONDS OR COMPLETE SEARCHES IN MINUTES . THESE MEMORIES WILL SERVE AS INDEXES TO THE DELUGE OF TECHNICAL LITERATURE WHEN THE PROBLEMS OF INPUT AND OF THE AUTOMATIC GENERATION OF CLASSIFICATION INFORMATION ARE SOLVED . DOCUMENT FILES WILL MAKE THE INDEXED LITERATURE READILY AVAILABLE TO THE SEARCHER . HOWEVER , MEMORY CAPACITY IS CURRENTLY WELL AHEAD OF OUR ABILITY TO USE IT , AND MUCH WORK REMAINS IN THIS AREA . MACHINE TRANSLATION OF LANGUAGES AND RECOGNITION OF SPOKEN INFORMATION ARE *TWO OTHER AREAS WHICH WILL REQUIRE FAST , LARGE MEMORIES .

33. A SUGGESTED CLASSIFICATION FOR THE LITERATURE OF DOCUMENTATION . THE CLASSIFICATION SCHEME PRESENTED HERE HAD ITS ORIGIN IN A CLASS PROJECT UNDERTAKEN BY STUDENTS AT THE UNIVERSITYx OF CHICAGOx , GRADUATEx LIBRARYx SCHOOLx DURING THE SPRING QUARTER x1960 . A DESCRIPTION OF THE PRINCIPAL FEATURES OF THE CLASSIFICATION WITH REFERENCE TO HAYKINx 'S xSIX BASIC BUILDING RULES FOR SPECIAL CLASSIFICATION IS FOLLOWED BY x2 APPENDICES : CLASSIFIED GUIDE TO AMERICANx DOCUMENTATIONx ; SUGGESTED CLASSIFICATION FOR THE LITERATURE OF DOCUMENTATION .

34. PROCEEDINGS OF THE ADIAx CONFERENCE . THIS INTERNATIONAL MEETING WAS SPONSORED BY : THE INTERNATIONALx FEDERATIONx FOR DOCUMENTATIONx ; THE JOINTx ENGINEERINGx COUNCILx ; THE GERMANx DOCUMENTATIONx SOCIETYx ; AND THE GMELINx INSTITUTEx OF INORGANICx CHEMISTRYx AND RELATEDx SCIENCESx IN THE MAX-PLANCKx SOCIETYx FOR THE ADVANCEMENTx OF SCIENCEx . THE PURPOSE OF THE CONFERENCE WAS TO PRESENT A CRITICAL EVALUATION OF THE NEEDS AND POSSIBILITIES FOR EFFECTIVE DOCUMENTATION SYSTEMS .

35. AUTOMATIC SELECTION AND REPRODUCTION OF INDUSTRIAL DOCUMENTS . THE SYSTEM DESCRIBED EMPLOYS xTHREE ESTABLISHED TECHNIQUES : MICROFILMING, PUNCHED-CARDS , AND XEROGRAPHY . DOCUMENTS TO BE HELD ON FILE ARE MICROFILMED . EACH INDIVIDUAL PICTURE IS CUT OFF THE REEL OF MICROFILM AND MOUNTED OVER A SPECIAL APERTURE CUT IN A STANDARD xEIGHTY-COLUMN PUNCHED-CARD . DATA IDENTIFYING THE MICROFILM ARE PUNCHED IN COLUMNS AVAILABLE ON THE CARD . WHEN THE DOCUMENT IS TO BE REPRODUCED , THE APPROPRIATE CARD IS SELECTED EITHER MANUALLY OR MECHANICALLY FROM THE FILE OF CARDS AND PLACED IN A SPECIAL PROJECTOR MOUNTED ON A XEROGRAPHIC PRINTER . THE REQUIRED NUMBER OF FULL-SIZE DOCUMENTS IS THEN PRINTED AUTOMATICALLY AT A SPEED OF xTWENTY FEET A MINUTE . THE SYSTEM IS PARTICULARLY SUITED TO THE FILING AND REPRODUCTION OF ENGINEERING DRAWINGS . x600,000 DRAWINGS CAN BE RECORDED AND FILED IN A SPACE OF x50 SQUARE FEET . MACHINES OF VARYING COMPLEXITY ARE AVAILABLE FOR MOUNTING MICROFILM ON THE CARDS , THE SIMPLEST BEING A SMALL , MANUALLY OPERATED , PORTABLE UNIT . DETAILS ARE GIVEN OF THE COPYFLOx HIGH-SPEED PRINTER , AND THE WAY IN WHICH THE SYSTEM IS OPERATED BY THE WESTINGHOUSEx ELECTRICx CORPORATIONx IS DESCRIBED , WITH FIGURES OF SAVINGS ACHIEVED IN STORAGE SPACE AND IN COSTS OF DRAWING-OFFICE SUPPLIES AND OF REPRODUCTION DRAWINGS .

36. THE AUTOMATICx MICROFILMx INFORMATIONx SYSTEMx . A DESCRIPTION OF THE AUTOMATICx MICROFILMx INFORMATIONx SYSTEMx AND HOW IT WORKS . IT IS A FAST SYSTEM FOR THE RETRIEVAL OF DOCUMENTS IN LARGE FILES WHEN THE CALL NUMBER OF THE DOCUMENT IS KNOWN . IT IS NOT A SYSTEM FOR THE SEARCHING OF THE LITERATURE IN THE FILES .

37. TECHNICAL INVESTIGATION OF ELEMENTS OF A MECHANIZED LIBRARY SYSTEM . SUMMARIZES THE DESIGN AND CONSTRUCTION EFFORTS ON FEASIBILITY MODELS OF A MEMORY WHICH STORES DOCUMENTARY INFORMATION IN THE FORM OF MICROPHOTOGRAPHS ; A CAMERA DESIGNED TO PREPARE THESE MICROPHOTOGRAPHS ; AN OUTPUT SYSTEM DESIGNED TO DISPLAY AND REPRODUCE THE INFORMATION CONTENT OF THE MEMORY . THE MEMORY HAS BEEN DESIGNED TO PROVIDE AN ACCESS TIME OF BETWEEN x0.3 AND x2.0 SECONDS TO APPROXIMATELY x1,000,000 DOCUMENT PAGES ; THE CAMERA TO PRODUCE MICROPHOTOGRAPHS HAVING LINEAR REDUCTION RATIOS OF x70 TO 1 AND x140 TO 1 , AND TO ARRANGE THEM FOR STORAGE IN THE MEMORY . OF THE x2 OUTPUT SYSTEMS DESIGNED , ONE STORES THE CONTENT OF A SELECTED MICROPHOTOGRAPH TEMPORARILY IN AN ELECTROSTATIC STORAGE TUBE AND DISPLAYS IT ON A CATHODE RAY TUBE SCREEN ; THE xSECOND REPRODUCES ON MICROFILM THE MICROPHOTOGRAPHS SELECTED FROM THE MEMORY . FEASIBILITY MODELS HAVE BEEN CONSTRUCTED AND ARE UNDERGOING FINAL TESTS BEFORE BEING INSTALLED IN AN EXPERIMENTAL SYSTEM PLANNED FOR DEMONSTRATION PURPOSES .

38. INTRODUCTION TO SCIENTIFIC DOCUMENTATION . THE BOOK COMPRISES x4 CHAPTERS AND A SUBJECT INDEX . THE x1ST CHAPTER LAYS STRESS ON THE ROLE AND SIGNIFICANCE OF DOCUMENTATION . THE AUTHORS RECOUNT THE ORIGINS AND DEVELOPMENT OF DOCUMENTATION AND ITS PRESENT ORGANIZATION ABROAD AND IN RUMANIAx , ESPECIALLY IN SCIENCE AND TECHNICAL SUBJECTS . AN ATTEMPT IS MADE TO CLARIFY SOME CONCEPTIONS , MAKE THE TERMINOLOGY MORE PRECISE AND TO EXPLAIN THE DIFFICULTIES CONNECTED WITH DOCUMENTATION . IN THE x2ND CHAPTER THE AUTHORS GIVE US THE MAIN SOURCES OF DOCUMENTATION . THEY DISCUSS CARD-INDEXES , LIBRARIES AND INSTITUTIONS DEALING WITH DOCUMENTATION . THE x3RD CHAPTER POINTS OUT THE DIFFERENT KINDS OF DOCUMENTATION ACCORDING TO THE SOURCE , CONTENT AND VALUE OF THEIR INFORMATION . THESE KINDS ARE : GRAPHICAL , PICTORIAL , AUDITORY , VISUAL , ETC. . THE x4TH CHAPTER SHOWS THE STAGES OF DOCUMENTATION INCLUDING RESEARCH WORK , PLANNING OF DOCUMENTATION , COLLECTING AND INVESTIGATING THE SOURCES AND USE OF DOCUMENTS . THERE IS A VERY USEFUL SUPPLEMENT OF BIBLIOGRAPHIC TERMS IN RUMANIANx , HUNGARIAN x , POLISHx , SERBO-CROATIANx AND SPANISHx .

39. THE YUGOSLAVx BIBLIOGRAPHICALx INSTITUTE . DESCRIPTION OF THE INSTITUTEx , FOUNDED IN x1948 , AND ITS SERVICES . WORK IS CARRIED ON BY x4 DIVISIONS : BIBLIOGRAPHICALx ; REFERENCEx AND DOCUMENTATIONx ; INTERNATIONALx EXCHANGEx OF PUBLICATIONSx CENTREx ; AND TECHNICALx PRINTINGx DIVISIONx .

40. SCIENTIFIC LITERATURE USE : A SURVEY . THE AUTHOR DRAWS , FROM REPORTS BY BERNALx , HERNERx , AND URQUHARTx ON THE WAYS IN WHICH SCIENTIFIC PERSONNEL GATHER INFORMATION , SOME OBSERVATIONS AS TO CERTAIN GENERAL PRACTICES AND ATTITUDES AMONG SCIENTISTS WHICH HE BELIEVES SHOULD BE KEPT IN MIND BY THOSE WHO MANAGE SCIENCE LIBRARIES .

41. HOUSE ORGANS AND TRADE PUBLICATIONS AS INFORMATION SOURCES . SUGGESTS SOLUTIONS FOR THE ACQUISITION AND HANDLING OF HOUSE ORGANS AND OTHER TRADE PUBLICATIONS . THESE PUBLICATIONS OFTEN INCLUDE INFORMATION WHICH IS NOT REPORTED IN THE TRADITIONAL MASS MEDIA EFFORT . A LIST OF THE TRADE PUBLICATIONS OF INTEREST TO THE CHEMICAL INDUSTRY IS INCLUDED .

42. PLEA FOR THE EXPANSION OF MEDICAL INFORMATION . THE EVER INCREASING NEED FOR A MORE EFFICIENT ORGANIZATION OF MEDICAL INFORMATION IN THE SOVIETx UNIONx INDICATES THAT THE PRESENT DECENTRALIZED AND INEFFICIENT SYSTEM OF MEDICAL DOCUMENTATION SHOULD BE REPLACED WITH A CENTRALIZED SYSTEM . THE CENTRALIZATION OF MEDICAL DOCUMENTATION WOULD PERMIT A BETTER UTILIZATION OF MEANS AND PERSONNEL ALREADY AVAILABLE TO VARIOUS ORGANIZATIONS ENGAGED IN MEDICAL DOCUMENTATION AND BETTER DISSEMINATION OF INFORMATION THROUGH IMPROVEMENT IN METHODS OF PRESENTATION AND ENLARGEMENT OF THE SCOPE OF MEDICAL DOCUMENTATION .

43. GROWTH OF CHEMICAL LITERATURE : PAST , PRESENT , AND FUTURE . ACTIVITY OF CHEMICALx ABSTRACTx SHOWS MARKED GROWTH : JOURNALS COVERED BY CAx IN x1907 WERE x475 , IN x1960 , x9800 JOURNALS COVERED . NEW JOURNALS IN CHEMISTRY INCREASING ABOUT x500 PER YEAR . IN x1960 THE x104,484 ARTICLES ABSTRACTED CAME FROM x97 COUNTRIES IN x52 LANGUAGES . x27,675 PATENTS WERE ABSTRACTED THE SAME YEAR . RUSSIANx CHEMICAL RESEARCH PROGRESS IS SO GREAT THAT IF U.S.x AND U.S.S.R.x RATES OF GROWTH CONTINUE UNCHANGED , THE U.S.S.R.x WILL OVERTAKE THE U.S.x IN x1965 . SUPPORT IS NEEDED FOR DEVELOPING EXISTING TOOLS AND DEVELOPING NEW INFORMATION SERVICES .

44. SOVIETx SCIENCE INFORMATION SERVICES . THIS IS A REPORT OF U.S.x ABSTRACTING AND INDEXING SPECIALISTS WHO OBSERVED THE OPERATIONS OF THE CENTRALIZED SCIENCE INFORMATION SERVIC OF THE ALL-UNIONx INSTITUTEx OF SCIENTIFICx AND TECHNICALx INFORMATIONx OF THE U.S.S.R.x . VINITIx IS PURPORTED TO BE THE x1ST COMPLETELY CENTRALIZED INFORMATION SERVICE IN THE WORLD .

45. ON THE VARYING TASKS OF TECHNICAL LIBRARIANSHIP AND DOCUMENTATION . A DESCRIPTION OF HUNGARY* 'S NETWORK OF TECHNICAL LIBRARIES WITH THE HUNGARIAN* CENTRAL* TECHNICAL* LIBRARY* AS ITS CORE . AN ACCOUNT IS GIVEN OF TASKS CURRENTLY BEING UNDERTAKEN , SUCH AS DECENTRALIZATION IN THE ACQUISITION OF TECHNICAL LITERATURE , AND NATIONAL CONTROL OF SUBSCRIPTIONS TO TECHNICAL PERIODICALS IN ORDER TO BUILD GREATER VARIETY IN COLLECTIONS .

46. HISTORY AND FURTHER DEVELOPMENT OF SCIENTIFIC-TECHNICAL INFORMATION , ESPECIALLY IN CZECHOSLOVAKIA* . THE RELATIONSHIP OF THE LIBRARY TO SOCIETY IS BRIEFLY TRACED AND THE DEVELOPMENT OF TECHNICAL LIBRARIES IS DISCUSSED . THE DEVELOPMENT OF SCIENTIFIC-TECHNICAL INFORMATION CENTERS IN CZECHOSLOVAKIA* AFTER *1945 IS DESCRIBED . THE MAIN FUNCTIONS OF THESE CENTERS ARE OUTLINED . THE NUCLEUS CONSISTS OF THE CENTRAL* TECHNICAL* LIBRARY* IN PRAGUE* , WHICH IS AUGMENTED BY A TECHNICAL* BRANCH* AND THE LIBRARY* OF THE BUREAU* FOR STANDARDIZATION* AND PATENTS* . THE DOCUMENTATION* BRANCH* OF THE MINISTRY* FOR PRODUCTION* AND THE DOCUMENTATION BRANCHES OF THE RESEARCH INSTITUTES OR OF THE LARGE PRODUCTION CENTERS AS WELL AS THE TECHNICAL INDUSTRIAL LIBRARIES CONSTITUTE OTHER CENTERS .

47. DOCUMENTATION AND ECONOMY . FUNDAMENTAL PROBLEMS OF DOCUMENTATION ARE DISCUSSED FROM THE PROFESSIONAL AND ORGANIZATIONAL POINT OF VIEW . IT IS STATED EMPHATICALLY THAT THE EXPERT MUST BE PROVIDED WITH THE MATERIAL FOR HIS WORK WHATEVER THE FINANCIAL COST . DEVELOPMENT IN DOCUMENTATION IN WEST* GERMANY* MUST TAKE THE FORM OF COOPERATION BETWEEN INSTITUTIONS STAFFED BY HIGHLY QUALIFIED PERSONNEL . COMPLETE CENTRALIZATION AS IN THE SOVIET* UNION* IS NEITHER POSSIBLE NOR DESIRABLE . DOCUMENTARY ACTIVITY WILL BE COORDINATED AT NATIONAL LEVEL BY THE PROPOSED INSTITUT* FUR DOKUMENTATIONSWESEN* .

48. BUREAU* OF SHIPS* RAPID* SELECTOR* . BRIEFLY DESCRIBES THE RAPID* SELECTOR* PROGRAM OF THE BUREAU* OF SHIPS* WHICH USES A PROTOTYPE RAPID* SELECTOR* , DESIGNED TO SATISFY THE NEED FOR INFORMATION RETRIEVAL ON A WHOLE-PAGE OR TOTAL-DOCUMENT BASIS . THIS PROGRAM COMPLEMENTS THE BUREAU 'S WELL-ESTABLISHED CARDOTYPE* INFORMATION RETRIEVAL PROGRAM , IN WHICH THE INDIVIDUAL LINES AND PARAGRAPHS ARE THE RETRIEVAL UNITS EMPLOYED MOST FREQUENTLY .

49. MAKING CLASSIFICATION SYSTEMS FOR PUNCHED-CARD CODING . COUNTLESS EFFORTS HAVE BEEN MADE TO INVENT NEW CLASSIFICATION SYSTEMS AND IMPROVE ON OLD ONES . THESE EFFORTS ARE BEING INTENSIFIED TODAY BECAUSE OF THEIR APPLICATIONS IN MECHANIZED SYSTEMS . SOME OF THE REQUIREMENTS AND ADVANTAGES OF CLASSIFICATION SYSTEMS ARE DISCUSSED .

50. GUIDE TO MICROREPRODUCTION EQUIPMENT . PROVIDES TIMELY AND ACCURATE FACTUAL COMPARABLE DATA , INCLUDING ILLUSTRATIONS AND PRICES , FOR ALL KNOWN MICROREPRODUCTION EQUIPMENT MANUFACTURED OR SOLD IN THE U.S.x . THIS x2ND EDITION UPDATES THE INFORMATION FOUND IN ITS PREDECESSOR , ELIMINATES OBSOLETE AND DISCONTINUED ITEMS AND EXTENDS COVERAGE TO MANY NEW AREAS SUCH AS HIGH CAPACITY STORAGE AND RETRIEVAL AND DATA MANAGEMENT . IT IS CLASSIFIED AND INDEXED .

APPENDIX 4.

THE FIRST FIVE ABSTRACTS OF JANASKE 1962 : UNEDITED VERSION.

1 ABE, K.

The Japan Information Center of
Science and Technology and its
activities.
Aslib Proc. 11(11):301-304. Nov. 1959.

A general description of the Japan Information Center of Science and Technology which was established for the purpose of contributing to the development of science and technology by collecting, processing, storing, and retrieving scientific information. At the time of this report, the Center was planning to change over to a mechanized storage and retrieval system similar to that used by the U.S. Patent Office. Services available from the Center and the charges for each are listed.

2 ACKOFF, R.L.

Report on a study of scientific communications for the National Science
Foundation.
In Shera, J.H., Kent, A., and
Perry, J.W., ed. Information systems in documentation, p. 66-74.
New York, Interscience, 1957.

This reviews the initial reasoning and thinking behind the design and construction of a project supported by the National Science Foundation, carried out by the Operations Research Group at the Case Institute of Technology to determine ways "to affect the behavior of scientific institutions that are responsible for the dissemination of recorded information in order to achieve a net improvement in scientific productivity."

3 ADAMS, S.

Problems in communicating Russian
science.
Fed. Proc. 16(3):716-720. Sept. 1957.

An outline of the National Institutes of Health Russian scientific translation program, with a discussion of the problems of selection, form, distribution, acceptability, and translation rights. © ADI

4 ADDINALL, C.R., and STECHER, P.G.

Searching medicinal chemical literature.
Amer. Chem. Soc. Advn. Chem. Ser.
30:121-126. Ref. 1961.

Three representative problems of a manufacturer of fine chemicals in searching for information in the medical and chemical literature:searching the botanical drug literature for folk remedies; interpreting and determining the content of foreign prescriptions; and tracing and identifying the Merck references.

5 ADKINSON, B.W.

The federal government and U.S.
scientific information.
J.Chem.Doc. 2(1):48-50. Jan. 1962.

In addition to presenting a general review of the scope of the Federal Government's role in research and development, and a review of the character of the Federal Government's scientific information activities, this article presents a review of the six-point program which has been developed by the National Science Foundation for improving the dissemination of scientific information, particularly among U.S. scientists and engineers. The author concludes that the dessemination of scientific information must be recognized as an integral part of research and development.

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1970b "The Deep Structure of Relative Clauses". In *Working Papers in Linguistics N° 6*, The Ohio State University, Columbus, Ohio, 41-58.

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